

*Full Length Research Paper*

# **Applicability of information and communication technologies (ICTs) in the administration of technical and vocational education and training (TVET) in a knowledge-based society**

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**Despite the belief that Information and Communication Technologies (ICTs) integration makes impact on the entire educational set up, studies directed to ICTs in schools have placed too much emphasis on the variables at class level neglecting other areas which ICTs are applied (for example, administration). In order to have distributed literature the present paper examines ICTs incorporation from the administration perspective. Specifically, the paper reviewed and expatiate literature on the applicability of ICTs in administration of Technical and Vocational Education and Training (TVET) which specifically covers an overview of ICTs application in educational administration and its implication on TVET. Contents of documents (journals articles, reports, conference proceedings, discussion papers) were scrutinized. The scrutiny reveals that e-accounting, e-procurement and Radio Frequency Identification Systems (RFID) are new tools that will be applied in financial, staff and students' administrative support services for TVET.**

**Key words:** ICT, Administration and TVET.

## **INTRODUCTION**

Information and Communication Technologies (ICTs) application in Technical Education and Training has been gaining popularity in the academic cycle of the 21<sup>st</sup> century (Buntat et al., 2010), beyond mere mentioning; its acceptability yielded a variety of recognition and made

it one of the 21<sup>st</sup> century icons that attract researcher's attention. Apart from ICTs widest acceptability and its application in teaching learning process, ICTs are also recognized to make impact in the administrative and management activities in higher education (Horn and Siew, 2011; Hashim et al., 2010). According to Miller et al. (2006) ICTs can be used in schools for administration, planning, lesson delivery and students assignment in the area of teaching and learning.

While various researches (Louw et al., 2009) have investigated the factors that augment incorporation of ICTs into teaching and learning process as well as the constraints to the successful integration (Saud et al., 2011), quite few researches are readily available and

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**Abbreviations:** ICTs, Information and Communication Technologies; TVET, Technical and Vocational Education and Training; RFID, Radio Frequency Identification Systems; IICD, International Institute for Communication and Development.

accessible on students' perceptions of ICTs use and their impact on their learning. Consequently, while the interest of educationist and general public on the use and integration of ICTs in education is on the increase, studies in this area is still in its infancy, especially that which focus on ICTs use in administration and management and which specifically deals with Technical and Vocational Education and Training (TVET) administration.

### Objectives of the paper

The main objective of this paper is to analyze the contents and expatiate on the literature from documents (journal articles, textbooks, reports, discussion papers, conference proceedings) written by scholars on ICTs application in the administration of TVET. Specifically, the paper would review literature on: an overview of ICTs application in TVET administration, applicability of ICTs in some area of TVET administration, where accounting/financial administration, students and staff administrative support services are discussed.

### Research questions

Based on the specific objectives, the following research question were formulated and answered by the literature search:

1. What is the general overview of ICTs application in educational administration?
2. What are the areas in which ICTs are applied in TVET administration?

### METHODOLOGY

The data in this paper were collected from document analysis from different relevant journal articles, textbooks, reports, discussion papers, conference proceedings written by scholars in the area of ICT application in education administration. The contents of the documents were read and analyzed by the researchers. Majority of the papers were downloaded through Universiti Teknologi Malaysia (UTM) library website ([www.utm.my/psz](http://www.utm.my/psz)). Prominent search engines, Google and yahoo at <http://google.com>, and <http://yahoo.com> were mostly used for documents access.

### Significance of the paper

Though, the research involved secondary data from documents analysis only, but the concept of ICTs application in TVET administration has been clearly highlighted and as a result gives more and deep understanding to interested intending researchers in the field of TVET and ICTs. Consequently, how ICTs are applied in general education administration and its implication in TVET administration are reflected and could serve as additional literature

on ICTs application in TVET administration.

## OVERVIEW OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) APPLICATION IN EDUCATIONAL ADMINISTRATION

ICTs are indispensable tools in the administration of higher education. Electronic management (e-management) facilitates decision making in an organization (Hashim et al., 2010). Deployment of ICTs in administration of schools as suggested by International Institute for Communication and Development (IICD) "needs to be strengthened in order to manage and plan activities more effectively. Information is mostly in hardcopy format and is not easily accessible. Data about teachers, salaries, student grades, the number of pupils per class, and statistical information in general are scattered and are not readily available" (IICD, 2007).

School administrators need to be equipped with knowledge, competencies and should have a deep understanding of educational and social dimension of ICT integration. Educational understanding or dimension includes application of ICTs in curricular, technical, management and financial aspects, while social dimension referred to understanding how ICTs are applied in day to day social interaction (Tinio, 2003). ICTs should be ubiquitous in educational administrative offices and "mainly helps administrators get a better idea of the size of the educational system, student dropout and repetition, and the number of students per teacher" (Canoy, 2004).

Studies on the application of ICTs in the administration of education reveals major achievements; a study on the use of e-learning software among future school heads in educational management and leadership reveals that e-headship succeeded in promoting teaching and learning strategies to a higher degree (Moh'd et al., 2009). *E-sekolah* management system application has been perceived by its users (head masters, administrative staff and teachers) to help create the report faster by saving the data into the digital content, and saving the time to preparing the lesson plan.

ICTs help administrators perform school duties effectively (Zain et al., 2004), increase and provide information to the finger tips of administrators (Picciano, 1998; in Gulbahar, 2007) and build very conducive atmosphere for work. Consequently, UNESCO IITE (2011) noted that "ICTs facilitates the administration of education and training, the provision of learning content and communication between learners and between teachers and learners". Though, UNESCO IITE noted the contribution ICTs make in educational administration,

Asiabaka (2010) found lack of usage by majority of principals in government secondary schools.

## **APPLICABILITY OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) IN SOME AREAS OF TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) ADMINISTRATION**

The use of ICTs at the administrative level of any educational setting as discussed in the preceding paragraphs is also evident in TVET being part of general education, a programme specially designed to prepare individual for occupational fields. Application of ICTs in administration of TVET in the context of this paper will be based on the five out of eight concepts identified by Chinien (2003) in his analytical survey on the use of ICTs in TVET. According to Chinien (2003), ICTs have been very efficient and effectively used in TVET for the administrative purposes that includes; accounting, staff administrative services, student administrative services, support services, research and evaluation. Chinien (2003) further tabulates his concept as shown in the Table 1.

### **Applicability of information and communication technologies (ICTs) in technical and vocational education and training (TVET) financial administration /accounting**

The records of purchases, budget, grants administration, cash flow, audits and other financial transaction carried out by institutions needs proper documentation for reference purposes. These records were kept in hardcopies before the introduction of ICTs. Fortunately, the availability and accessibility of ICTs and their integration in financial sector makes it possible and easy for accountants and financial administrators to process all transaction on-line via the system called an e-accounting. Electronic accounting (e-accounting) as the name implies, makes it possible for transactions to be captured, measured, recognized and reported electronically (Razae et al., 2001).

E-procurement is another new paradigm taking lead into financial administration as a result of development in Information technology. E-procurement according to Bof and Previtali (2010) "is a collective term for a range of different technologies that can be used to automate the internal and external processes associated with the sourcing and ordering process of goods and services". They further states that "On-line purchases and payment for goods and services in virtual markets constitute crucial elements of e-procurement. Successful adoption leads to potential benefits, which include the reduction of transaction costs, operational efficiencies, and a better foundation for decision making". Considering the specialized nature of TVET systems, and its peculiarity in

terms of requirement for different varieties of training materials or consumables, e-procurement system can fit and be beneficial in dealing with purchases and supply. While e-procurement has impact on cost reduction, efficiency/productivity, effectiveness and transparency, its adaption in TVET system is essential. Panayiotou et al. (2004) in their study on "e-procurement system for governmental purchasing" developed a model that summarizes the context, improvement and expected benefits of e-procurement to organizations shown in Figure 1.

Deployment of ICTs in TVET administration using tools such as e-accounting and e-procurement will to a greater extent make significant impact on the growth and development of the programme. "The benefits of e-procurement in public organizations will be the following:

1. acceleration of execution times of procedures;
2. reducing the time of the purchasing process;
3. reducing the expenses of announcements management
4. simplification of processes, resulting from a re-engineering of such processes;
5. the direct and constant monitoring of public spending by conducting comparative analysis between the purchasing of similar products in different administrations;
6. professional growth of employees;
7. the opportunity to spend time out of routinely administrative tasks (automated by new tools) through activities with higher added value to the function-specific purchases (e.g. marketing intelligence);
8. a major transparency due to the uniformity of access to information without discrimination since the tender documents are online, to the standardization of procedures to ensure that processes can be more easily controlled by external actors in time and according to the quality of services provided in that each supplier will not be discriminated against (for example, information asymmetries)" (Bof and Previtali, 2010).

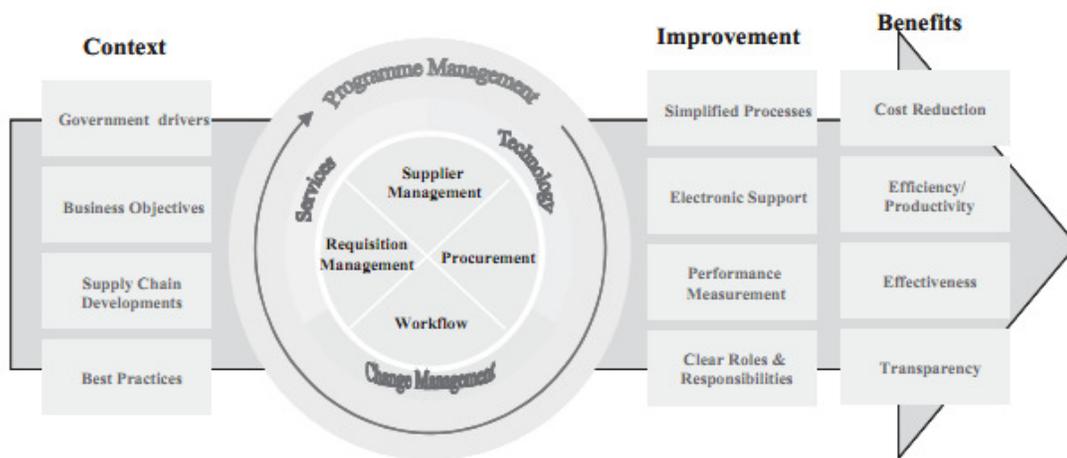
This is in line with UNESCO and ILO (2002) recommendations that "administrators should keep up to date with new administrative techniques and trends, especially through relevant lifelong learning programmes. They should receive special training in the methods and problems associated with the specific features of technical and vocational education programmes, such as flexible entry and re-entry patterns, continuous training in the workplace, and relevance to the needs of the world of work. This preparation should include:

- (a) Management methods appropriate to educational administration, including techniques that utilize information and communication technologies;

**Table 1.** Administrative uses of ICTs.

Use of ICTs	Specific function
Accounting	Budgeting, purchasing, grants administration, cash flow, account receivable, account payable, audits.
Staff administrative services	Human resources management - assessing staffing needs, recruiting staff, monitoring staff performance keeping records, communicating with staff. Human resources development - conducting needs assessments, needs analyses and training needs analyses, delivering and assessing employee training.
Student administrative services	Recruiting and selecting students, advising students, supporting prior learning assessment and recognition, registration, recording attendance, record, and fee payment.
Support services	Providing programme information - calendar featuring programme and course description; pre-requisites and other requirements; keeping records to comply with freedom of access to information; maintaining web site giving access to administrative units, faculties and departments; managing computer and e-mail accounts for faculties and students.
Research and evaluation	Conducting institutional research, programme evaluations, and student assessments of faculties; statistical analyses.

Source: Chinien (2003).



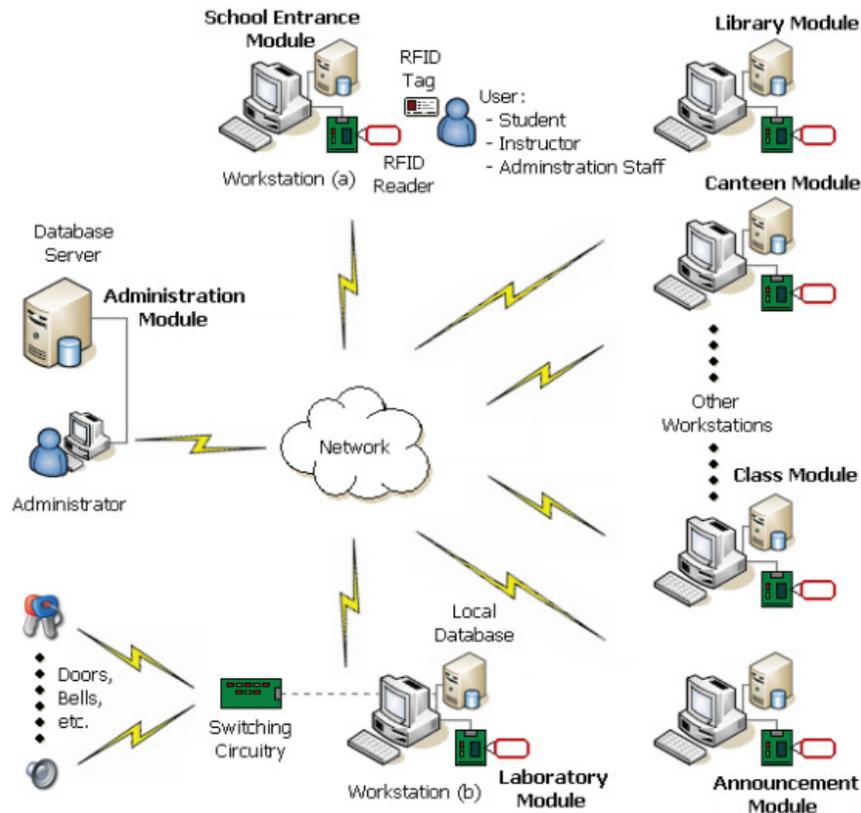
**Figure 1.** E-procurement benefits model adopted from Panayiotou et al. (2004).

(b) Financial planning methods that facilitate the allocation of available resources, given the objectives and priorities of the various programmes, and ensure their efficient utilization;

(c) Contemporary human resources management and development methods” (UNESCO and ILO, 2002).

### **Applicability of information and communication technologies (ICTs) in students’ administrative support services**

Students administrative services using information technologies application packages are too numerous to



**Figure 2.** Block diagram of RFID system (Akpinar and Kaptan, 2010).

mention in this era of ICT dispensation. Its application into both applied and physical sciences (Rodríguez and Antón, 2011) is evident in the wealth of literature on ICTs. ICTs simplify the administrative support services offered to students in various levels of their academic pursuit in both formal and informal TVET, student's services like records, admission/recruitment, class schedules, attendance, registration, time tabling and accessing result can be realized via network of computers and other communication avenues called student portal (Horn and Siew, 2011).

The inventory management, personal records maintenance and library systems are areas that are mostly affected in the field of TVET. This in essence connected to the peculiar nature of the field and in its desire to prepare workers with certain competencies and employability skills. Facilities management, tools and equipment inventory and workshop schedules make it necessary for TVET to deploy and fully integrate ICTs in its day-to-day operations. Students of TVET should be able to book for tools and machineries needed to carry out certain experiments online or by using ICTs. Therefore, TVET institutions should have to embrace the

use of technology in both staff and student's administrative services (Leung et al., 2005). ICT tools such as e-tutor and e-student systems could provide significant atmosphere in the preparation of technical education graduates to face the challenges for the world of work in the 21<sup>st</sup> century (Seng, 2007).

Several ICTs and computer-aided administration application packages highly enriched with current and emerging technologies are readily available and can be found to support student's activities in schools and colleges. Among these latest ICT tools, Radio Frequency Identification (RFID) system appeared to be one. According to Akpir and Kaptan (2010), "RFID is a term that is used to describe a system that transmits the identity of an object or person in the form of a unique serial number, using radio waves (details in Figure 2).

Apart from its numerous applications that cut across human endeavor, RFID application in educational administration include "automatic person identification system (APIS), class/laboratory/library attendance management, static/dynamic authorization, submission of warnings/announcements and e-money usage" (Akpinar and Kaptan, 2010). The flexibility and richness of this system

**Table 2.** Ways in which teachers use ICT to support their work.

S/NO.	Ways in which teachers use ICT to support their work
A	Resource/material preparation
i.	Lesson planning
ii.	Report writing
iii.	Curriculum planning
iv.	As a lesson resource ( for example, website)
v.	Timetabling
vi.	School policy development
vii.	Reprographics/photocopying
viii.	Presentations/demonstrations
ix.	Monitoring pupil progress
x.	Marking and assessment
xi.	Record keeping (for example, database entry)
xii.	Special Educational Needs Coordination (SENCO)
xiii.	Development planning
xiv.	Exam entries and results
xv.	Records of achievement
xvi.	Extra curriculum activities
B.	Registration
i.	Staff appraisal/supervision or mentoring
ii.	Monitoring attendance
iii.	On-line communities
iv.	Financial records
v.	Continuing professional development/training
vi.	Budgeting
vii.	Partnership links (contact outside the school)
viii.	Pupil contact (for example, E-mail/intranet)
ix.	Staff contact (for example, arranging meetings through E-mail/intranet)
x	On-line purchasing of services and/or goods
C.	Parent/career contact (for example, E-mail)

Source: Selwood (2005).

RFID makes it more appropriate and suitable in TVET administration. Looking at the Figure 2, apart from its classrooms application, the system can also be applied to monitor activities in the laboratories. Laboratories/workshops are central to TVET, hence, TVET according to UNESCO Institute for Information Technologies in education in (2011) “is concerned with the acquisition of knowledge and skills for the world of work to increase opportunities for productive work, sustainable livelihoods, personal empowerment and socio-economic development for both women and men, in both urban and rural communities and also ICTs are tools in the provision of TVET”

Apart from students offering TVET courses in schools and colleges, those offering the courses at distance needs support via ICTs in so many ways ranging from registration, result access, documentation, courses information retrieval, inquiries etc. Strong and reliable ICTs network enables students to have access to course material and support services any where any time. Wonacott (2002) states that;

“Distance students must rely on secure, easily accessible ICT for clear, detailed information about enrolment, modules, courses, requirements, assessments, expectations, and sources of help; the opportunity to enroll, pay fees, and complete all administrative procedures; regular contact and timely response and feedback from instructors; a variety of methods to communicate with teachers (e-mail, online chat, bulletin boards); enrolment information linked to application forms; and online assessments” (Wonacott, 2002).

#### **Applicability of information and communication technologies (ICTs) in staff administrative support services**

Staff administrative support services is achievable through effective ICTs integration. Due to the distinct nature of TVET system, administration support requires ICT tools embedded in them special features meant to take care of the management of training facilities, tools and equipments both in hard and soft copies. Horn and Siew (2011) notes that ICT tools such as Facility Management System (FMS), File Booking System (FBS), Building Control Management System (BCMS) and Resource Tracking and Management System (RTMS) could help both staff and students to use university facilities conveniently. Though their study was conducted in universities, it is equally important to acknowledge the use of such ICT tools for administrative support for both students and teachers in an academic cycle. In a related study on the “Primary School Teachers’ use of ICT for administration and management, Selwood (2005) presents list describing the ways in which teachers use ICT to support their work (Table 2).

Table 2 provides a comprehensive summary of the ways teachers use ICTs in handling curricular and extracurricular activities. The implication for TVET teachers/staff will be on the aspects of online purchase of goods and services (consumables and repairs) and resources record keeping. Record keeping using ICTs help TVET staff especially workshop/laboratory instructors/attendants fast track the movement of tools, equipments and machineries in use by students. This is to avoid double allocation and to reduce the risk of

injuries due to congestion in the work spaces. Appropriate safety regulations will also be applied smoothly using appropriate ICT tools in TVET. Mumcu and Usluel (2010) observes that teachers in vocational and technical schools use ICTs most frequently for managerial purposes and least in teaching learning processes.

## CONCLUSION

ICTs application in TVET cannot be overemphasized in the present era when demands in "ICT capability" skills are on the increase. Deployment of ICT tools to support financial services, staff and student's administrative support services in TVET institutions have been identified as central elements in attaining the sound vocational and technical training programme. Emerging ICTs in financial management (e-accounting and e-procurement) and their availability were found to applicable and makes significant impact in the smooth running of organizations financial sectors. Therefore, the deployment of these tools would definitely help TVET system financial administrators handle their job effectively, and minimizes error.

Due to the unique nature of TVET, ICTs application for the support of staff and students administrative services could differ slightly in the way and manner ICTs are applied in general education administration. The differences observed in this paper are on the uses of ICTs to help staff and students in workshop/laboratory scheduling, tracking/monitoring as well as retrieval of tools, equipments and machineries. These services in TVET require special systems like RFID and expertise for proper operation.

## REFERENCES

- Akpinar S, Kaptan H (2010). Computer aided school administration system using RFID technology. *Procedia - Social Behav. Sci.*, 2(2): 4392-4397.
- Asiabaka IP (2010). Access and Use of Information and Communication Technology (ICT) For Administrative Purposes by Principals of Government Secondary Schools in Nigeria. *The Researcher*, 2(1): 43-50] (ISSN: Available at <http://www.sciencepub.net/researcher>
- Bof F, Previtali P (2010). National models of public (e)-procurement in Europe *Journal of e-Government Studies and Best Practices*. Available online at <http://www.ibimapublishing.com/journals/JEGSBP/2010/315295/315295.pdf>
- Buntat Y, Saud MS, Dahar A, Arifikin KS, Zaid YH (2010) Computer Technology Application and Vocational Education: A Review of Literature and Research. *Eur. J. Soc. Sci.*, 14(4).
- Canoy M (2004). ICTs in education: Possibilities and Challenges. Inaugural lecture of the 2004-2005 Academic Year. Universitat Oberta de Catalunya. Available at <http://www.uoc.edu/inaugural04/eng/canoy1004.pdf>
- Chinien C (2003). The Use of ICTs in Technical and Vocational Education and Training. Analytical Survey. UNESCO Institute for Information Technologies in Education (IITE), Moscow.
- Gulbahar Y (2007). Technology planning: A road map to successful technology integration in schools. *Computers & Education*. 49: 943-956. Elsevier Ltd.
- Hashim F, Mahabubul Alam G, Siraj S (2010). Information and communication technology for participatory based decision-making-E-management for administrative efficiency in Higher Education. *Int. J. Phys. Sci.*, 5(4): 383-392, Available online at <http://www.academicjournals.org/IJPS>
- Horn MC, Siew K PW (2011). Enabling Teaching and Learning Through the Use of ICT in Singapore Universities. The Workshop on Analysis of Cross-Border Higher Education for Regional Integration and Labour Market in East Asia Bangkok, Thailand. Available online at [http://www.rihed.seameo.org/uploadfiles/ict/ICT\\_Singapore.pdf](http://www.rihed.seameo.org/uploadfiles/ict/ICT_Singapore.pdf)
- Institute for Information and Communication Development (2007). Using ICT in the education sector. Available at <http://www.iicd.org/files/ICT-in-the-education-sector.pdf/>
- Leung K, Bryne J, Cheong F (2005). The use of ICT in the delivery of online services and its impact on student satisfaction at RMIT University. In weert tv & Tatnall (ed). *Information and Communication Technologies and Real-life learning*. Springer Science+Business Media.
- Louw J, Louw J, Brown C, Muller J, Soudien C (2009). "Instructional technologies in social science instruction in South Africa", *Computers and Education*, 53(2): 234-42.
- Miller L, Naidoo M, van Belle J-P, Chigona W (2006). "School-level ICT Adoption Factors in the Western Cape Schools. Technology for Education in Developing Countries. Fourth IEEE International Workshop; 57-61. Available online at <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&number=1648410&isnumber=34561>
- Mumcu FK, usluel YK (2010). ICT in vocational and technical schools: teachers' instructional, managerial and personal use matters. *Turkish online J. Edu. Technol.*, 9(1). Available online at <http://www.tojet.net/articles/9112.pdf>
- Moh'd NN, Ibrahim S, Hamza MI, Moh'd Z, Embi MA (2009). Using open source software to design and develop an online learning material in education management and leadership. 13<sup>th</sup> UNESCO-APEID International Conference and World Bank-KERIS High Level Seminar on ICT in Education 24-26 March 2009, Bangkok, Thailand.
- Panayiotou NA, Gayialis SP, Tatsiopoulus IP (2004). "An e-Procurement System for Governmental purchasing", *Int. J. Prod. Econ.*, 90: 79-102.
- Razaee Z, Elam R, Sharbatoghlie A (2001). Continuous Auditing: the Audit of the Future. *Manage.l Auditing J.*, 16(3) 150-158.
- Rodríguez GS, Antón AJM (2011). The use of ICT tools in Physical Sciences Education. *Int. J. Phys. Sci.*, 6(4): 944-947, 18 February, 2011. Available online at <http://www.academicjournals.org/IJPS>
- Saud MS, Shu'aibu B, Yahaya N, Yasin MA (2011). Effective integration of information and communication technologies (ICTs) in technical and vocational education and training (TVET) toward knowledge management in the changing world of work. *Afr.J. Bus. Manage.*, 5(16): 6668-6673.
- Selwood I (2005). Primary School Teachers' Use of ICT for Administration and Management. In A. Tatnall, J. Osorio & A. Visscher (Eds.), *Information Technology and Educational Management in the Knowledge Society*. 170: 11-22. Springer Boston.
- Seng LS (2007). Vocational technical education and economic development – the singapore experience. ITE Paper No. 9: Paper presented to members of a World Bank Delegation on an Asian Education Study Visit to the Institute of Technical Education, Singapore, on 22 June 2006. Retrieved on 25/04/2011 from [http://www.ite.edu.sg/about\\_ite/ITE\\_Conference\\_Papers](http://www.ite.edu.sg/about_ite/ITE_Conference_Papers)
- Tinio VL (2003). ICT in education. E-Primers for information economy, society and policy. Available online at <http://www.eprimers.org/ict/>
- UNESCO, ILO (2002) Revised Recommendation concerning Technical and Vocational Education (2001). Paris: UNESCO; Geneva,

Switzerland: <http://unesdoc.unesco.org>  
Wonacott ME (2002). Blending Face-to-Face and Distance Learning Methods in Adult and Career-Technical Education. Educational Resources Information Center (ERIC). Available at <http://www.calpro-online.org/eric/docs/pab00032.pdf>

Zain MZM, Atan H, Idrus RM (2004). The impact of information and communication technology (ICT) on the management practices of Malaysian Smart Schools. *Int. J. Edu. Dev.*, 24(2): 201-211.