

**National Conference on ICT in Education
24 – 26 March 2006
International Convention Centre
Berakas, BSB, Brunei Darussalam**

**Integrating ICT into Teaching & Learning
Concepts, implementation and challenges: A Bruneian Perspective.**

*Chong Jon Fong, MA (King's College London), B.Sc (Hons), Dip. Edu.
Chairperson, Secondary School-Based ICT Subject Committee,
Department of Schools, Ministry of Education.
HOD ICT, SM Rimba, Gadong.*

Abstract

Empowering teachers and learners with ICT skills opens up a world of learning unavailable in the past and is crucial to achieving success in today's global knowledge economy. This paper will discuss the concepts of technology integration and the precise roles that ICT could play in enhancing teaching and learning. The paper will also discuss various problems and challenges faced by teachers in implementing ICT in teaching & learning. The role of school administrators, heads of departments and ICT coordinators and teachers will also be addressed.

Introduction

One of the challenges for the government of Brunei today is to produce Bruneians who are able to play their part in the present day knowledge-based economy and yet, at the same time, remain imbued with strong Islamic and Malay values. To meet this challenge, the Brunei Darussalam Information Technology Council (BIT Council) was formed in October 2000 with the aim to lead and facilitate the strategic development and diffusion of the state-of-the-art IT for the entire nation (www.bit.gov.bn).

To produce Bruneians who are able to participate fully in the knowledge-based economy of the twenty-first century, who are also technologically literate, there is a need for paradigm shift in education. ICT, primarily computers, is one of the major tools that can be used to achieve this goal. In this respect, the Ministry of Education has a very important role to play such as providing the ICT infrastructure and training needed in schools.

In the year 1991, Computer Studies was introduced as an optional subject to lower and upper government secondary schools as a major step towards providing computer literacy to students. To facilitate ICT implementation in schools, all secondary schools were provided with ICT lab in 2000. Following that, Project "Internet for Schools" was conceptualized and implemented by the Department of ICT. A further step was made when a joint initiative project between the Ministry of Education and BAE Systems (UK) was implemented by the end of 2002 in four primary and secondary schools in Brunei

Darussalam. The project's initial activity was a five day (23rd to the 29th October 2002) ICT and Design training course organized by the BAE System for a total of 80 teachers and officers from the Department of Schools, Department of ICT and Department of Curriculum Development. Courses covered during the training were CAS/CAM & Interactive Whiteboard Applications, Design and Technology for Primary and Secondary schools. From 14th July to 23rd October 2003, 275 primary and secondary teachers had been trained under the Project "Integrating ICT Across School Curriculum". Other ICT related courses also were conducted from time to time by various departments in the Ministry of Education.

The Secondary School Based ICT Subject Committee's effort in organizing IT training for teachers has seen more than 250 teachers trained with IT skills since 2002 using MS PowerPoint, HotPotatoes, Macromedia Flash and HyperStudio. These teachers are now able to develop Micro-Lessons/Multimedia Courseware in various subject areas.

A very important step forward made by MOE was the provision of unlimited internet access facility not only for teachers but also for students since 2002.

What is ICT Integration?

Let's begin with looking at the word ICT. ICT (information and communications technology) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (www.whatis.com). Webopedia, an online Encyclopedia, defines ICT as the study or business of developing and using technology to process information and aid communications. With these in mind, ICT integration should not be confined to computers only, it should include all other communication devices.

Integrating technology with teaching means the use of learning technologies to introduce, reinforce, supplement and extend skills (Pisapia, 1993). For example, if students are instructed to read certain topic in a textbook without any follow-up activities, the book is not integrated. If students are just provided with computers to play games or surf the net without clear follow-up activities that leads to mastering of certain skills, there is no ICT integration.

Providing ICT facilities and related programs is not enough to enable teachers and students to acquire the skills and proficiencies to use them effectively (Breuleux, 2001). It is Breuleux's contention that ICT can, indeed, support more powerful and complete knowledge-building experiences for learners "*if we integrate well-designed technologies in the context of meaningful, mindful inquiry projects, non-presentational pedagogies, access to resources and tools, and adequate support for technological maintenance and pedagogical renewal*" (Breuleux, 2001, p. 3). Roblyer (1997) states that the most important and the most difficult challenge in ICT is how teachers can help to improve existing conditions or to create important educational opportunities that did not

exist without ICT. As part of this process, teachers decide what they need to make these changes occur. This process of determining where and how technology fits is known among educators of educational technology as integration.

Why Integrate ICT in Learning?

The predominant conception of the potential of computers in education was that students would be 'taught' by computers, and that the computers would 'take over' the teacher's role. That was the conception more than 2 decades ago. However, towards the end of the 1980s and into the 1990s, educators believe that having computers in schools was not to replace teachers but to improve student learning and teachers play the role of a facilitator.

Bringing computers into the classrooms will transform the way our schools function and our children are taught. Warschauer (1996) asserts that ICT can enhance student motivation by helping students gain knowledge and skills about using computers, open up opportunities for electronic communication. Learning becomes meaningful when teachers carefully integrate computer activities into the regular structure of a lesson.

Some positive effects of Integrating ICT in Learning were found in a research conducted in Malaysia which suggests that the Smart Schools were more effective in promoting the Malay and English language achievement of Form Two students than were Traditional schools (Ang Jit Eng, 2002). Findings based on a research report (Harold Wenglinsky, 1998) on academic achievement reported that academic achievement in mathematics and the social environment of the school were positively related to:

- ✚ teacher's professional development in technology;
- ✚ the use of computers to teach higher-order thinking skills; and
- ✚ the frequency of home computer use (eighth-graders only).

Many documented literature has shown that the quality of learning can be significantly enhanced when ICT is approached and utilised as an intellectual 'multi-tool', adaptable to learners' needs (Davis et al., 1997). Research (Bransford et al, 1999) also shows that ICT can enhance:

- ✚ critical thinking;
- ✚ information handling skills
- ✚ higher level conceptualization
- ✚ problem solving.

The literature shows that (Leach 2000, Leach et al., 2002) ICT can facilitate:

- ✚ the refining of understanding;
- ✚ the giving and receiving of feedback;
- ✚ collaborative tasks;
- ✚ joint decision making and reflection;
- ✚ complex group interactions.

In addition, because many new technologies are interactive they are already being used extensively to create and sustain a wide range of collaborative processes and activity. Teachers empowered with ICT skills are capable of creating a rich learning environment. By integrating technology into everyday classroom activities appropriately, teachers have the opportunity to create a world of new learning experiences that learners had never experienced before. ICT Integration can help to reinforce, supplement and extend student skills.

It is generally accepted that schools in the twenty-first century should equip students with both the confidence and the ability to use new technologies effectively and creatively in every aspect of their lives. Alongside with this is a growing acceptance of the potential of technological tools in revolutionizing teaching and learning. The following excerpts strongly reflect the importance of ICT in fostering the development of a workforce prepared to meet the challenges of the 21st century.

'...e-learning must now touch the life of every single learner... All learners, from pre-school to lifelong learning, can benefit from mixing these new technologies with other forms of study... Online services are an increasing part of everyday life, and education and training must mirror these changes to revolutionise all learning.' (Charles Clarke, DfES, 2003)

'We should be reminded that ICT connectivity is not about how many computers are in schools, but how teachers and learners use various technologies to achieve educational goals and improve their teaching and learning experiences.' (Ministry of Education, South Africa, 2003)

'...ICT can stimulate, motivate and spark students' appetites for learning and helps to create a culture of success. This can be demonstrated in their increased commitment to the learning task, their enhanced enjoyment, interest and sense of achievement in learning when using ICT, and their enhanced self esteem.' (Becta, 2003)

"..citizens of the twenty-first century will require knowledge and skills that enable them to be creative and enterprising. Initiative, risk-taking, lateral thinking and resourcefulness will be vital to success. People will need to be flexible and adaptive in a society that is changing economically and socially. They will need to be technologically competent, capable of using the opportunities of the digital world and self-managing of careers that may change many times. As life-long learners, they will need to continue to access education and training" (p. 1, Curriculum Council's -1999)

Role of ICT

ICT should not be seen as a “vitamin” whose mere presence in schools can produce better educational outcomes. The concept of ICT in education should include systems that enable information gathering, management, manipulation, access, and communication in various forms. In an effort to narrow the gap of digital divide, ICT should be used as an enabler to reduce the digital gap amongst students within the school and between schools.

Often arguments for school reform involve constructivist concepts such as the need for students to develop higher order thinking skills and the failure of current schooling methodologies to provide the opportunity (Campione, Brown, & Jay, 1990; Loader & Neville, 1991). In the extreme, the technologies of the information age are perceived to be an irresistible force on education (Mehlinger, 1996).

Therefore, Education Reform entails moving away from memory-based learning designed for the average to an education that stimulates thinking, creativity, and caring for all students, caters to individual differences and learning styles, and is based on more equitable access.

It should be stressed that only effective Integration of ICT can result in meaningful learning. What is meaningful learning? Meaningful learning is learning that leads to a sense of understanding and is connected to the personal experience or other knowledge which the learner possesses. Meaningful learning is seen as necessary for scholastic achievement, for making one’s way in a complex world, and for engaging in problem solving. The opportunity to interact with other learners in sharing, discussing, constructing and negotiating meaning leads to knowledge construction. This is in contrast with traditional learning environment where learning mainly happens in classrooms without integration of technologies. Teachers have the opportunity to use technology in different ways: drill and practice, tutorials, simulations, problem-solving and productivity tools

Effective use of ICT in classrooms enhances the learning process in the following ways (www.TechKnowLogia.org, Timika Sandridge, EDU506)

- ✚ ICT can motivate learners
- ✚ ICT promotes active learning
- ✚ ICT can provide learners with unlimited practice required to master basic skills
- ✚ ICT allows learners to investigate reality and build up knowledge
- ✚ ICT provides tools to increase student productivity
- ✚ ICT promotes higher thinking skills
- ✚ ICT allows learners the opportunity to work at their own pace
- ✚ ICT allows learners more control of their own learning
- ✚ ICT facilitates collaborative and cooperative learning
- ✚ ICT promotes independent learning
- ✚ ICT offers an opportunity to accommodate differing learning styles
- ✚ ICT gives learners instant feedback to their responses

Effective use of technology not only enhances learning process but also can influence instructional practices in a variety of ways.

- ✚ ICT increases teachers' instructional capabilities
- ✚ ICT allows teachers to use technologies as excellent instructional aids to engage students in the learning process.
- ✚ ICT capabilities could be exploited for specific lessons and to suit teacher's needs
- ✚ ICT provides opportunities for teachers to explore and acquire timely and relevant information quickly
- ✚ ICT allows teachers to produce better-looking, more "student friendly" materials more quickly
- ✚ ICT use may encourage teachers to assign tasks which require students to engage in higher level thinking.
- ✚ ICT brings abstract concepts to life.
- ✚ ICT helps learners visualize problems and solutions
- ✚ ICT helps tracking learner progress

Effective ICT integration offers a number of key advantages: (www.intel.com)

- ✚ It allows learning anywhere at any time, extending the classroom boundaries and the learning experience.
- ✚ Provides for distance learning, removing the requirement to physically attend a course, eliminating travel time and costs. It also allows community e-learning education centres to be set up in remote locations where conventional classes would be prohibitively expensive.
- ✚ Creative content such as simulations and game-based learning can be developed to explain learning points in interesting, absorbing and imaginative ways.
- ✚ The pace can be adjusted by the learner, repeated as often as required.
- ✚ Smart adaptive learning programs can automatically personalise the overall experience to the style best suited to the individual learner.
- ✚ Embedded links can seamlessly provide access to a wealth of additional support and reference materials, such as further content, online libraries, educational establishments and useful Web sites.

Problems and Challenges

Though most schools in Brunei have been provided with one or more computer laboratories with full internet access, educators have been particularly concerned that very little of the potential of computers to support learning in schools seems to have been realized. One of the reasons often given for this anomaly is that the technology is not sufficiently accessible, particularly if students have to go to a special room to gain access.

Many teachers may argue that integrating technologies into teaching and learning, especially computers, make teaching more difficult. It takes time in planning to incorporate ICT into a lesson, to sort out the logistics (if the lessons is to be conducted in a classroom), to make sure the hardware and software are available, and to design a fall back lesson if something technical hitch arises.

It cannot be denied that integrating technology into the teaching and learning process takes a great deal of effort by the teacher. You have to know what software is available and appropriate, how to locate it, retrieve it, and capture it for classroom use. Someone needs to know how to guide and encourage students' efforts to explore the subjects in more depth, how to organize the class to complement traditional teaching.

Research has shown that teachers were more likely to have begun using ICT at the suggestion of their ICT coordinator, rather than starting on their own initiative or because of suggestions from school administrators or teaching colleagues (Becker, 1992). In Brunei, there is no exception.

Although ICT holds great potentials in enhancing learning, several challenges remain. These challenges include:

- Adequate ICT infrastructure in classrooms
- Skilled manpower
- Teacher attitude and mindset
- Quality and relevant courseware
- Time constraints
- Training programs and e-awareness campaigns
- Training for trainers
- Student ICT skills
- Access to ICT resources
- Administrative support and monitoring
- Defined role of ICT coordinators
- Content development for ICT oriented curriculum
- Hardware maintenance
- Coordination amongst various government education coordinating agencies
- Support from other government agencies and private sectors
- Broadband access, network access and cost of service
- Safe and Responsible Online
- Examination system.

This list is not exhaustive but represents the major challenges that surface in the implementation of ICT across curriculum.

Our neighbouring countries, like Singapore and Malaysia, had started ICT integration into teaching and learning many years ago. Based on their experiences, the following factors will contribute to the success of ICT integration.

- Teachers have acquired a good level of computer literacy
- Teachers' readiness and awareness
- Inclusion of ICT component as part and parcel of the curriculum
- Effective role of School Administrators and ICT coordinators
- Students have a good level of computer literacy
- Adequate ICT equipment
- Relevant educational software

Integrating ICT into Teaching and Learning

School leaders should seek to drive developments towards a vision of the school as a centre of excellence in using ICT for teaching and learning. A vision for ICT should describe an achievable future for the school and not something too ideal as to be unattainable. (NAACE, 2004)

Good leadership and effective coordination will be the main factors contributing to effective and successful ICT Integration in schools. ICT is not a subject that can be delegated to an ICT Coordinator. In practice the leadership and coordination roles will complement one another and work towards achieving a shared vision. Principals, deputy principals (Academic), ICT Coordinators and academic subject HODs will each demonstrate a leadership role with ICT.

Role of Principals

Principals can foster an environment for change by taking an active approach to innovation and having a clear vision for ICT integration. They should facilitate the formulation of a strategy to integrate ICT into teaching and learning and utilize key people with sound ICT knowledge and skills in managing the change.

Principals can promote staff participation in the ICT integration process by:

- developing their own ICT capability
- identifying long-term goals and implementing strategies for ICT integration
- encouraging their staff to accept ICT integration as a priority
- giving priority to staff training in ICT
- ensuring adequate time and resources for ICT integration
- stressing classroom applications of ICT during staff meetings

- monitoring every teacher's progress in ICT skills and integration
- seeking parental involvement and support through parent workshops and meetings.

A survey on School Heads' professional profile and roles on ICT implementation across Europe which was carried out in May 2005, reflects that leadership issues are a major concern in several countries. (www.someurl.com/somepage.htm). Principals are the role models for the teaching and learning process in schools. Great principals can make ICT integration happen and a success.

However, principals do not work alone. Principals need to frequently refer to and work with a second or even a third change facilitator- the deputy principal, and the ICT coordinator. These persons should work collaboratively as a team to address the concerns of teachers and offering them direct help with specific aspects of ICT hence overcoming any barriers that may impede the successful integration of ICT.

Role of ICT Coordinators

ICT Coordinators and school leaders should work hand in hand in moving the school towards a defined vision for successful implementation of school ICT plan. ICT coordinators have a number of roles within a school. 'ICT in Schools - the Effect of Government Initiatives', Ofsted found that: The coordination of ICT demands a considerable range of expertise, requiring good ICT understanding and knowledge, technical skills and the ability to provide professional support. The ICT coordinator acts as a role model using ICT skills in everyday work and is keeping abreast of new government initiatives in ICT and new hardware and software developments.

An effective ICT coordinator plays the following roles:

- Coordinating and preparing an ICT development plan
- Developing strategies for integration of ICT across the curriculum
- Liaising with senior management and advising on ICT strategies
- Keeping senior management and teachers aware of key developments in ICT
- Disseminating relevant information on integration of ICT
- Helping other departments to Identify appropriate opportunities across the curriculum where ICT can enrich teaching and learning
- Identifying training needs and supporting staff development in the use of ICT across subjects facilitating staff training
- Evaluating the use of ICT in school. Monitoring, assessing and reporting ICT development in school.
- Coordinating the purchase and maintenance of equipment, software and courseware
- Providing a timetable for teacher use of ICT lab

- Providing current website links
- Identifying solutions to obstacles to ICT developments

Role of Teachers

Teachers are a key component in the learning environment and therefore the impact of ICT on teachers and the strategies they employ to facilitate the environment are critical. Teachers who serve as subject department heads play a key role in promoting ICT integration among their department staff. HODs who view positively ICT as a teaching and learning tool will help greatly in generating interest and enthusiasm among their teachers in taking a different approach to teaching by using computers as a tool to support learning. HODs will help teachers to understand relationship between computers and learning and create a student-centered learning environment. This leads to changes in the composition of the role of teachers. For successful ICT integration, teachers play the role of a manager, designer and facilitator.

In playing the role of a manager, a teacher plans a viable rotation schedule for necessary uninterrupted access to ICT facilities and provides a multidimensional learning environment. He needs to develop the ability to evaluate and select software relevant to learning goals. As a designer, a teacher creates ICT integrated lesson plans with problems where data manipulation by students is required, utilizes multiple learning resources and real-world data. As a facilitator, the teacher no longer plays the role of a subject-content expert but provides necessary scaffolding for knowledge building. He facilitates learning by asking directed questions and provides opportunity for problem-solving processes and technical tasks. He has to be creative and flexible and at the same time possess logistic, organizational and collaborating skills necessary for successful integration of ICT.

Conclusion:

We cannot deny that students of the 21st century need to develop learning skills that enable them to think critically, analyze information, communicate, collaborate, and problem-solve in today's knowledge-based society. ICT plays an essential role in realizing these learning skills. Towards achieving this goal, schools in Brunei both primary and secondary have been provided with the infrastructure necessary for the integration of ICT in teaching and learning. However, effective ICT integration must also be supported by a vision of learning through technology, equitable access and use of technology by students, ICT integrated curriculum, ongoing professional development and technical support.

So, where do we go from here? School leaders need to develop a vision and work plan of how technology can improve teaching and learning in which students are actively involved in the learning process. Schools to organize and schedule access to technology to provide equitable opportunities to students to use technology in meaningful, authentic tasks that develop higher-

order thinking skills. Successful integration of ICT depends largely on teachers' support for innovation. It is thus important to provide professional development to teachers to help them choose the most appropriate technologies and instructional strategies that enable students to benefit from technology. Adequate infrastructure and technical support is essential to promote ICT integration. Teachers must have access to on-site technical support personnel who are responsible for troubleshooting and assistance after the technology and lessons are in place. If teachers are working with a technology infrastructure that realistically cannot support the work they are trying to do, they will become frustrated. Above all, to facilitate ICT integration, it is worthwhile to integrate ICT component in the national curriculum which will not only enhance the use of technologies by teachers but also benefit student learning.

References

- A.K. Jager and A.H. Lokman. *Impacts of ICT in education. The role of the teacher and teacher training*. Paper Presented at the European Conference on Educational Research, Lahti, Finland 22 - 25 September 1999
- Ang, J.E. (2002). *Malay and English language achievement in schools*. Jurnal Pengurusan dan Kepimpinan Pendidikan, 12(2), 19-27.
- Ausubel, D. P., Novak, J. D., & Hanesian, H. (1978). *Educational Psychology: ACognitive View*. New York: Holt, Rinehart and Winston.
- Bransford, J.D; Brown, A.L.and Cocking, R.C.(Eds.) 1999, *How People Learn: Brain, Mind, Experience, and School* , Committee on Developments in the Science of Learning , National Research Council, National Academic Press.
- Bork, A. (1991). *Computers and educational systems*. Australian Educational Computing, 6 (2). 34-37.
- Breuleux, A. (2001). *Imagining the present, interpreting the possible, cultivating the future: Technology and the renewal of teaching and learning*. Education Canada, Vol. 41(3).
- Campione, J. C., Brown, A. L., & Jay, M. (1990). Computers in a community of learners. In E. DeCorte & M. C. Linn & H. Mandl & L. Verschaffel (Eds.), *Computer-based learning environments and problem-solving* (pp. 163-188). Berlin: Springer-Verlag.
- Curriculum Council's (1999) *Post Compulsory Education Review Discussion Paper*
- Crawford, D. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2002* (pp. 716-720). Chesapeake, VA: AACE.
- Davis, N., Desforges, C. et al. (1997) 'Can Quality in Learning be Enhanced through the use of IT?' in Somekh, B. and Davis, N. *Using Information Technology Effectively in Teaching and Learning*, London, Routledge.
- Harold Wenglinsky (1998) *Does it Compute? The Relationship between Educational Technology and Student Achievement in Mathematics*. Princeton, NJ: Educational Testing Service. www.ets.org/research/pic
- Lim, C. & Khine, M. (2006). *Managing Teachers' Barriers to ICT Integration in Singapore Schools*. Journal of Technology and Teacher Education. 14 (1), pp. 97-125. Chesapeake, VA: AACE.

Leach et al., *Building teachers' professional knowledge through ICT: experience and analysis across the 'digital divide'*. Paper Presented at the European Conference on Educational Research, University of Lisbon, September 11th - 14th 2002

March, T. (2001). *What's on the Web?* Retrieved June 29, 2004, from www.ozline.com/learning/webtypes.html

Mehlinger, H. D. (1996). *School reform in the information age*. Phi Delta Kappan, 77(6), 400-407.

Moonen, J. & Kommers, P. (1995). *Implementatie van Communicatie- en Informatietechnologie in het onderwijs*. Enschede: OCTO, University of Twente.

Paola Forcheri et al., *ICT Driven Individual Learning: New Opportunities and Perspectives*. Educational Technology & Society 3(1) 2000

Paul Newhouse, Sue Trinidad, and Barney Clarkson. *A Teacher Professional ICT Attributes Framework – Outcomes, Guidelines, Equipment and Processes* December, 2002.

Paul Newhouse. *A Framework to Articulate the Impact of ICT on Learning in Schools*, Specialist Educational Services, December, 2002.

Paul Newhouse, Sue Trinidad & Barney Clarkson. *Quality Pedagogy and Effective Learning with Information and Communications Technologies (ICT): a review of the literature*. Specialist Educational Services, December, 2002.

Pisapia, J. & Perleman, S. (1993). *Learning Technologies in the Classroom: A Study of Results*. Richmond VA: MERC.

Pisapia, J. (1993, April). *Learning technologies in the classroom: Case studies of technology intensive schools*.

Roblyer, M.D, Edwards, J. and Havriluk, M.A. (1997). *Integrating educational technology into teaching*. Upper Saddle River.NJ: Prentice Hall.

Schuck, S. (2002). *Professional development of teacher educators: The eChange Project example*.

SER (1998). *ICT en onderwijs*. Den Haag: SER Sociaal-Economische Raad.

Timika Sandridge, *Elements that May Serve as a Rationale for Using Technology in Education*, Technology Projects in EDU506

Ramlee and Abu Abdullah (2000). *Implementation of IT and multimedia-related courses in technical and vocational education in Malaysia*. Paper presented at International Conference on Teacher and Vocational Education in Malaysia, Petaling Jaya, November 21-23 2000.

UNESCO (1998) World Education Report: Teachers and Teaching in a Changing World, Paris, UNESCO

UNESCO (2000) *Statistical Document: Education for All 2000 Assessment*.

UNESCO (2001) Teacher Education Through Distance Learning, Paris UNESCO