

TEACHER ORIENTATIONS TOWARD ICT IN EDUCATION

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Abstract: Information and communications technology (ICT) is increasingly being introduced into the school curricula and teacher education at a high cost. Yet, there are quite different orientations of teachers in Brunei toward ICT, depending on their own affinity toward the technology and their pedagogical orientations. Many teachers remain uninvolved saying they are uncertain about the benefits of ICT in students' learning. There are teachers who use ICT very instrumentally in presenting their lessons passively and also deliver drill and practice using the computer. However, it is encouraging that there are teachers and educators in teacher education in Brunei who are continuously exploring innovative, pragmatic and active ways of using ICT ecologically and effectively.

This paper will discuss the challenges facing teachers, policy-makers, teacher education, and day-to-day use of ICT in the classroom. Policies and delivery models need to be developed so that school and teacher education curricula can innovate new means of communication in order to open up new possibilities for education and bring about profound changes in traditional processes and transactions in teaching and learning. Different experiences and directions in ICT education in Brunei will be analysed and discussed. Important policy issues such as how to increase the quality of ICT education; the productivity of connectivity, through improved performance and reduced cost; and how to use connectivity to establish reliable knowledge networks and reduce information overload will be addressed.

INTRODUCTION

The on-going e-Government initiatives in Negara Brunei Darussalam are costly and include the introduction of Information and communications technology (ICT) into the school curricula and teacher education. Many "veteran" teachers are not so quite oriented toward ICT and the more independent pedagogical orientations that complement that approach of teaching. Many teachers remain uninvolved saying they are uncertain about the benefits of ICT in students' learning in an examination-oriented curriculum. Such pressures of achieving good results in public examinations drive teachers to use ICT very instrumentally in presenting their lessons passively and also deliver drill and practice of examination questions using the computer.

However, it is encouraging that there are teachers and educators in teacher education in Brunei who are continuously exploring innovative, pragmatic and active ways of using ICT ecologically and effectively (Sallimah & Leong, 2002). These teachers remain focused on students' understanding and performance in examinations. All school teachers in Brunei Darussalam are encouraged to integrate ICT into the teaching and learning of subjects across the curriculum. Teachers have positive attitudes toward application software, and the use of Internet and CD-ROM resources in planning their instruction. However, when it comes to using the resources directly in classroom instruction there are reservations. Teachers feel that commercially available instructional materials are not integrally-related to the school curriculum. Pedagogically, there are also concerns voiced that explanations of concepts are inadequate, the materials are not of high-interest, and culturally appropriate resources are difficult to find. More importantly, these teachers as novice technology users, have some difficulty in managing and keeping track of new software and other resources, have limited training, and think that it is too time-consuming to use the technology in an examination-oriented school system.

Besides the lack of educational software there are limited numbers of computers and ICT laboratories in schools. Classrooms are not equipped with computers, LCD projectors or Internet

access. All these factors and the loaded curriculum, examinations, and slow Internet access deter teachers from spending too much time on using ICT directly in their teaching.

To assist with the implementation of technological innovation in schools, we asked teachers for their views and preferences about the use of ICT in their teaching. These teachers expressed strong interest in having access to resources produced by Universiti Brunei Darussalam [UBD] as part of its ICT program. Many teachers have indicated they are willing to work with UBD students in the planning phase of the instructional design of ICT resources. In general, they prefer resources which are easy to use to more sophisticated technologies: PowerPoint to Flash; worksheets and stories to web quests; and resources tailored to Brunei curriculum to generic resources. These teachers strongly support an indexing system that matched resources to curriculum topics in the Brunei curriculum and want to be able to have easy access to the locally produced resources through a website or CD-ROM.

Teachers everywhere are trying to integrate ICT into the school curriculum. However, the rate of change of technology is very rapid and costly. Even businesses cannot acquire and replace hardware and software frequently. Schools will always lag behind. The limited budgets, the difficulties of networking the school and accessing Internet are challenges. There are no ready solutions, rather, schools and teachers have to deal with these realities. The solution lies in interactivity with local and global access to all of the world's available knowledge. This can develop students' curiosity, and preserve and encourage it in order to develop confidence and creativity in the ability to explore, communicate, create and develop knowledge. Teachers and students are encouraged to explore the Internet and come back into the class to talk about what they have found that is interesting or confusing, and share information and knowledge in creative ways.

Educators have to experiment with how all these can fit in with textbooks and the school syllabi and public examinations. Jonassen (1997) and Nicaise (1997) proposed ideas for computers to support learning activities: exploration, manipulation and articulation of what they have learned (speculation, conjecturing, hypothesis testing, and reflection on what they did). Teachers could support constructivist learning activities by modeling, coaching and scaffolding.

The advent of global networked computing in the 1990s has changed the environment and provided important new ways of using computers in the classroom (Warschauer, 1998). These new ways reveal a fundamental weakness in computer-assisted learning. Instrumental perspectives view technologies, in the traditional way, as isolated tools which can be used toward any ends (Feenberg, 1991). Ecological perspectives view technologies as social practices which become part of the ecology of human activity, both at an individual and socio-cultural level (Postman, 1993), and can be applied to all knowledge and language endeavors.

Making information and knowledge readily available not only transforms the work place, but also transforms education. It gives everybody an opportunity for greater involvement and communication—student to student within the classroom or across schools; student and teacher; and also teacher to teacher collaboration. They can build on each other's work. With ICT, teachers and students have opportunities to do that. The vision is of a connected learning community, and there will be more universities and schools building curricular resources up on their Web sites that can be accessible to all levels of education. The low-budget educational ICT initiative at Universiti Brunei Darussalam aims to provide ICT resources for all schools in the nation. Teachers and students outside of the country will also be able to access the resources freely. It is hoped that all primary and secondary school teachers, and students and their parents will be able to make use of these ICT resources in their own individual ways to enhance the quality of education, and more importantly to prepare students to live and work in an ICT world.

RESEARCH ON ICT IN EDUCATION

Research on teacher education by Germann and Sasse (1997) on the variations in concerns and attitudes of science teachers in an educational technology development program monitored changes in concerns and beliefs of 40 elementary and secondary teachers involved in a 2-year program to integrate the use of computers with science teaching. Results showed a decrease in self and management concerns, but an increase in impact concerns during the first year. However, in the second year, the teachers reverted back to higher self-concerns and decreased impact concerns. Although self-efficacy increased from pretest to posttest, the teachers found difficulties in adopting the approach. The barriers were time to prepare for teaching with computers, and availability of computers and software. The amount of time and personal effort required to gain confidence in more difficult technology applications may raise self-concern. In Brunei, the Ministry of Education is employing Higher National Diploma holders in computing to become teachers in primary schools. They work with trained teachers to utilize ICT resources in the ICT laboratories; and they attend a one-year teacher education program.

Cleland et al. (1999) examined the effects on science and mathematics instruction of professional development in multimedia-based technology for 26 inservice and 14 preservice teachers. Participants learned to use multimedia-based technology in an intensive, two-week summer institute, collaborated in developing integrative instructional units, and implemented the units during the following fall semester. Data from a variety of measures, including computer competency surveys, the Microcomputer Utilization in Teaching Efficacy Beliefs Instrument, computer usage logs, participant journals, classroom observations, and interviews using Levels of Use techniques showed that teachers demonstrated increased levels of competence and confidence in using technology for science and mathematics instruction.

The authors focused on three components critical to the success of this professional development model: linkage of pedagogy to technology; collaborative teacher planning of instructional units; and support during implementation to promote systemic change. This approach increased teachers' levels of competence and confidence in using the technology. Such training opportunities need to be provided by schools, school districts, and institutions of higher learning (Germann & Barrow, 1996). The writer has initiated an ICT project in UBD using this approach to promote the use of the technology in teaching and learning.

At UBD, ICT in education courses expose pre-service teachers to integration of ICT in the curriculum in order to increase the usage of computers in their own teaching. This approach has been reported to be useful in helping pre-service teachers progress from an early state of apprehensiveness to a definitive discovery of the educational possibilities of multimedia as an instructional method (Peters & O'Brien, 1996; Peters, O'Brien, Briscoe, & Korth, 1995).

In order to support and ensure success of the ICT efforts in schools, concerted and planned changes in the curriculum of teacher education, for both pre- and in-service are necessary. Pedagogy has also evolved from structural approaches to cognitive approaches to socio-cognitive approaches in teaching and learning. Warschauer (1998) suggested that both cognitive and socio-cognitive approaches can be considered "communicative." Yet while cognitive perspectives emphasize communication for the purpose of individual construction of language competence and knowledge, socio-cognitive perspectives emphasize communication for the purpose of apprenticing or immersing teachers and students into new discourse communities.

In current perspectives, learning means to become part of the community which speaks, reads, and writes about the knowledge. This involves authentic interaction and communication, such as that which takes place online. Since modern approaches to teaching emphasize interaction and communication in authentic contexts, the online environment provides an important context that ought not be ignored.

The suggestion is that computers and ICT resources should be part of the environment of learning, rather than as an optional instrument. This is consistent with views of literacy and knowledge development. Just as students learn to read and write in print environments, they also must learn to read and write in electronic environments for success in the 21st century.

THE CURRENT INITIATIVE TO SUPPORT LEARNING IN BRUNEI

Educational technologists and ICT specialists rely on instructional design (ID) procedures. The Dick and Carey Model (Dick, Carey & Carey, 2001) is one model often chosen to integrate educational technology products into the teaching-learning process. Since the design process considers every aspect of the larger teaching-learning process it covers too broad a range to be carried out by a single person. That is why ID is a team process employing content specialists, technology and resource specialists, educational psychologists, assessment specialists, team managers, as well as others. The better the specialty coverage in the team is the better the assurance that every aspect of the instruction will be given appropriate attention.

Resources are critically important in the teaching-learning process. The nature and quality of resources used have a significant impact on the teaching strategy and instrumentally on the degree of success of the overall activity. By extension, improving access and quality of teaching-learning resources opens the door to educational innovation and improved teaching in Brunei schools.

Innovation is more than change. It is change which can stand on its own, change which brings added value to society—invention which leads to added value over time. Improved access to resources for teachers in Brunei schools is innovative.

This project proposes to make two changes to the system of education in Brunei Darussalam. One is to initiate greater involvement of practising teachers in the resource-creating process that routinely goes on at UBD. The second is to provide access to students and teachers in Brunei's public education system to the products that are developed by UBD's educational technology and ICT students. Both these changes are small changes but they have the potential for profound impact in creativity as well as innovation in the educational system (Bollier, 2000).

At the centre of the project is a database. This database serves to organise and make available information on two levels:

1. Information to Sultan Hassanah Bolkuah Institute of Education (SHBIE) faculty and students about teachers willing to participate in resource development (improved Instructional Design).
2. Information to public school teachers and administration about ICT resources which have been created as part of the project (increased level of innovation).

These are both only slightly incremental changes over the status quo but they could emphatically influence choices teachers make each day with respect to what happens in their classrooms. The overall result could well affect the general quality of education in the country.

The short term goal of this project is to produce a database which catalogs the teachers who are willing to participate as school subject specialists and who are available to guide UBD students in developing of ICT teaching-learning resources.

The long term goal is to integrate the efforts of UBD faculty and students in improving the quality of technological resources produced and used by schools. This integration occurs on two levels: at the level of the employment of technology across the spectrum of curricula in Brunei Darussalam; and integration of the technology itself with the teachers who use it.

With an operable database, longitudinal studies can be developed which examine and evaluate the influence of technology on teaching allowing for the refinement of teaching-learning behaviors through the appropriate use of technology. The database becomes a critical component in the

interface of technological research in the schools which is the rationale for its creation in the first place.

In the shorter term the benefits of this database is a better knowledge of who we serve—the teachers, the subjects they teach and their willingness to participate in producing resources they feel the curriculum of the school could use. This statistical information is useful in its own right but its value in this respect is greatly eclipsed by the potential contribution it contains for bringing UBD and the schools together in implementing appropriate technology.

PROCEDURES

In the initial survey, 40 teachers in Brunei Darussalam were briefed about the project's intention to make technological resources available to the teaching staff at their schools. All the information coming out of the survey will be placed in a database giving UBD staff access to all teachers in Brunei. In general this database will inform SHBIE faculty and in particular educational technology and ICT faculty about the following aspects of the educational system that they serve

- Teachers' names and contact information
- School subjects that each teacher teaches
- Teacher willingness to act as a subject matter consultant in resource-creating projects

With access to this information, educational technologists at UBD can place pre-service teachers in contact with people working in the field. The result will be resources which have greater relevance and usability. Teachers in Brunei benefit by gaining resources they need and UBD students benefit by preparing resources which will be suitable for their own use when they enter the classroom in a year or two. Greater involvement leads to better planning and improved relationships between UBD, the teachers, and the students who are becoming teachers. The overall result should be better quality resources and greater understanding of the instructional design process as well as the people involved in their different but complementary roles.

Besides meeting the country's administrators and gathering the information, the UBD representatives input the information into a database so it is easily searchable, retrievable and updateable. To achieve all these ends student-assistants are assigned to the ICT lab which they would use as a workplace as well as provide services to UBD education faculty and students during regularly scheduled hours.

This approach has several advantages:

1. Student time is efficiently organized
2. UBD money is economically spent in getting three sets of services for the price of one
 - Liaison with schools
 - Constructing an information database
 - Providing services and resources to UBD faculty and students
3. Providing access to SHBIE lab at unscheduled times
4. Providing assistance to students with technology problems
5. Updating software on computers
6. Acting as an intermediary between students looking to produce resources and schools which need them

At the university's Department of Science and Mathematics Education (DOSME) ninth annual conference workshop session, teachers were able to download resources created in previous years from the hard-drives in the SHBIE computer laboratory. Response to this opportunity was so strong

that teachers returned on two successive days bringing others to share in the plethora of resources available to them. Such a magnanimous response is indicative of the potential in this project.

At the time this paper was written, nine secondary and 19 primary schools had been approached for teachers who would be willing to participate as subject specialists/consultants to UBD students working on technology resource projects. There were about 250 student teachers enrolled in primary and secondary education programs taking technology education courses during that semester. As the database of volunteer teachers were not yet available, the student teachers were asked to approach teachers they knew who would be willing to help them with the subject matter and activities.

FINDINGS

The wide range of subject areas and levels of teaching of these 120 teachers (74 primary and 46 secondary) and their commitment of time for UBD students are promising for this project. The following statistics are obtained from the developing database of volunteer subject specialists/consultants who would also want to make use of the ICT resources developed by UBD students with their guidance. The database has detailed information of these teachers including the actual class levels that they teach. Usually secondary school teachers teach one or two subjects but primary school teachers teach several subjects. The information will be made available to faculty and students at UBD. Table 1 and 2 show the subject areas and numbers of willing primary and secondary teachers respectively. The response from teachers is very encouraging.

Table 1
Primary School Teachers' Subject Areas(n=74)

Subject Area	No. of Teachers
Bahasa Arab	2
Bahasa Melayu	21
English	19
Geography	10
ICT	7
Lukisan	14
Mathematics	28
Pelajaran Am	11
Physical Education	7
Science	13
Sejarah	7
Sivik	10
Special Education	1
Ugama / IRK	3

Table 3 shows the amount of time that the teachers are willing to spend helping student teachers with their technology projects. Some of the teachers stated that they may not be good in technology but they can guide the students in the content, presentation and activities that are appropriate for effective primary and secondary school teaching and learning in their subject areas.

The high percentages of 42% of primary and 48% of secondary teachers willing to spend a lot of time helping student teachers in their projects are indicative of the support that they are willing to provide for such a collaborative effort of schools, the university and Ministry of Education.

Table 2
Secondary School Teachers' Subject Areas (n=46)

Subject Area	No. of Teachers
Art	6
Bahasa Melayu	8
Biology	1
Chemistry	4
Commerce	1
Computer Studies	7
Economics	1
English	6
Food and Nutrition	1
Geography	7
History	6
Malay Islam Beraja	4
Mathematics	5
Physical Education	3
Physics	1
Principles of Account	1
Science	15

Table 3
Teachers' Commitment of Time (n=120)

Time Period	Primary		Secondary	
	Freq	Percentage	Freq	Percentage
One meeting [1 hr]	39	53	17	37
Two meetings [2 hrs]	4	5	7	15
As long as it takes	31	42	22	48
Total No. of Teachers	74	100	46	100

Several groups of student teachers have produced technology resources for teaching and learning purposes. Some of the students' technology projects are posted and shared on the Internet by the students themselves as part of their project work. These student websites can be accessed from links at www.e-journalofeducation.com posted and maintained by the writer. Other student projects which carry very large video files are not able to be posted on free websites. These can be made available to teachers on CDs. Links have also been made from the writer's website to efforts of other teachers in Brunei who have on their own initiatives set up impressive portals for similar educational purposes. Two of such examples are:

Komuniti Guru Sepakat Brunei at <http://www.kgsb-online.com> and www.shahrizal.com

CONCLUSION

This project hopes to accomplish two things: the application of instructional design principles in a more realistic setting than has been available before; and the creation of a resource database which shows the network of teachers sharing similar resource needs. The project lays the

foundation for sharing UBD designed resources with everyone in the system—fostering an Equity Model to support teaching-learning activity in Brunei Darussalam.

The university needs to take leadership in this initiative. Drucker (1993) one of the world's most influential spokesmen for what constitutes good leadership suggests four things that good leaders should do.

1. Good leaders should practice wise use of time.
In the equity model underlying this project a resource is produced with the intention of sharing it from the beginning. New resources are created with a knowledge of what has gone before. This procedure conserves time ensuring that new resources either improve on earlier ones or explore areas of the subject which have not been touched by earlier efforts.
2. Good leaders should keep abreast new developments.
Teachers in the country's schools participate with UBD to develop resources using the latest technological developments to enhance their teaching.
3. Good leaders build on the strengths of their colleagues.
UBD students bring energy, vitality, and openness to solving educational problems. Practicing teachers bring experience, reality, and wisdom to the same set of problems. UBD faculty bring methodology, technological expertise, and quality assurance. The result is a synergy of contributions to the teaching-learning experience that ultimately unfolds in the classroom and affects Brunei's children.
4. Good leaders focus on the opportunities and downplay the problems.
The opportunity in this equity-model database is the creation of a structure facilitating action research in determining the impact of resources on teaching: what constitutes good quality; the differential effects of quality; effects of resources on choice of teaching strategy; the role of students in the development of resources; and many other areas. Of course there are problems and one of the greatest of these is to say it won't work. But good leaders downplay the problems.

Computers and technology should take their place as a natural and powerful part of the teaching and learning process, affecting both aspects of teaching and learning in three ways. This new technology influences how information is presented; how students interact both with the medium and through the medium with the teacher and other learners; and how knowledge is structured. Brumfit (1998) discussed issues of bilingual texts generating questions about awareness, the relationship between control and freedom in language learning, the positive effects of ICT on motivation, and also the close interaction between the data that we can derive from our teaching materials and research data that previously had not been available. All these are possibilities accelerated by new technological resources. Multimedia technology offers opportunities for creative expression and exploration in instructional activities that integrate mathematics, science and technology (Greenberg, 1998; Thomas, Johnson & Stevenson, 1996). With current multimedia, nonlinear access, autonomy and self-regulation are incorporated into software design. Most teachers now report that computer classes are even more popular than physical education classes. Learning and teaching should be fun and more independent now with the new technology.

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