Pacific Island Countries

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Australia

ICT USE IN EDUCATION

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National policies, strategies and programmes

The Australian Commonwealth (Federal) Government develops national policies and strategies for the use of information and communication technology (ICT) in primary, secondary and vocational education. Australian state and territory governments develop policies and strategies for the use of ICT in primary, secondary and vocational education, adult community education (ACE) and adult multicultural education (AMES). (See Appendix 1 for a glossary of acronyms used in this chapter.)

A range of implementation models and approaches are being adopted for the use of ICT in teaching and learning. The integration of ICT in education includes project-based, inquiry-based, individual and collaborative learning models. Students studying in the vocational sector (e.g., VET, TAFE) are increasingly required to undertake subjects and courses online or via a blended delivery mode of face-to-face and online learning. Online courses may include interactive multimedia courseware and online assessment tasks, tests and quizzes. Assessment of student learning may take place within a computerised learning management system such as WebCT or Blackboard, enabling teachers to track, assess and mark electronically submitted student work. In secondary and primary education, students may undertake project-based learning via Internet-based projects and specially developed online curriculum content.

Policy Goals and Action Plans

Overall, numerous policy goals and action plans have been developed and implemented at all government levels to enable the widespread implementation of ICT in all sectors of education. Policies, plans and strategies may be accessed via the government, organisational and taskforce websites listed in Appendix 2. Some strategies and initiatives extend outside of Australia and encompass neighbouring countries such as New Zealand.

Current Implementation

ICT in education is widely implemented throughout Australia at federal, state/territory and local government levels.

The non-formal education sector in Australia is extensive and includes ICT use in education conducted at neighbourhood houses, ACE, AMES, CAE, TAFE, University of the Third Age, local municipal libraries and community learning centres. However, these informal courses may also provide pathways into accredited ICT courses in accordance with the Australian Qualifications Framework (AQF).

Budget Allocations and Funding Sources

Funding for the implementation of ICT in education comes from federal and state/territory government budgets. Examples of budget allocations and expenditure for the implementation of ICT in education may be accessed via the federal and state/territory contact websites listed in Appendix 2.

Gaps, Limitations and Needs

Identified gaps, limitations and needs in ICT in education occur in relation to indigenous Australians, older Australians, women, people with disabilities, people in remote locations, and socio-economic disparities. Some initiatives have been introduced to enhance equity in these areas and are discussed under digital divide issues, concerning those who have access to ICT and those who do not.

Current level of ICT access and use

Table 1 provides a general overview of the current level of ICT use in primary, secondary, vocational and community education.

Digital Divide Issues

Educational policies and strategies have been developed to address identified digital divide issues at federal and state/territory government levels. These issues relate to indigenous and older Australians, women, people with disabilities, people in remote and rural locations, and those with relevant socio-economic factors.

Indigenous Australians. Some Aboriginal education policies promote ways in which new technologies can meet the learning needs of Aboriginal students. The Northern Territory DET's Indigenous Education Strategic Plan[1] proposes new communications networks for all schools including major remote sites, and all teachers to have a minimum level of computer literacy and related teaching competencies. Similarly, the New South Wales Department of School Education's Aboriginal Education Policy 1996 and Review 2001–2005[2] includes a proposal for research into the application of ICT to teaching and learning of Aboriginal languages, and ways that new technologies can be used to meet the learning needs of Aboriginal students.

Older Australians. The Federal Government programme Basic IT Enabling Skills (BITES) for Older Workers[3] provides workers aged 45 years and older with the opportunity to undergo nationally accredited training in ICT skills. Courses are also conducted for older Australians at nationwide campuses of the University of the Third Age[4] and at the Victorian CAE.[5]

Women. Education Queensland's Girls and ICTs Initiative[6] aims to build new pathways and models that break down barriers to girls' participation in, and enjoyment of, ICTs. Informal and formal ICT skills training is also conducted specifically for women at local ACE[7] providers, including women's neighbourhood houses. The Victorian Government's Women's Web Project[8] provides women in rural, isolated areas with Internet training and access to community Internet services. However, a "gender gap" persists: for example, in 2002, Education Queensland found that of those enrolled in the Year 12 course Information Processing and Technology, 22 per cent were girls, compared to 78 per cent boys. If this trend continues, girls

*Table 1: Technologies used in primary, secondary, vocational and community education**

Type of technology	Uses	Extent of use by sectors
Satellite broadband network, includes software that allows video/audio interaction between teachers and students, interactive whiteboard and controlled Internet access.	High-speed networking. General teaching and learning across the curriculum: project-based, inquiry-based, individual learning.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*
High-speed broadband telecommunications network.	High-speed networking. General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government and non-government primary and secondary.*
Hardware: desktop computers, printers, scanners, file servers, notebook computers, active local area network (LAN) products, uninterruptible power supplies (UPS).	General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE providers, CAE and AMES.*
Server software: Microsoft Education - Windows 2000, NT 4, Exchange 2000, SQL 2000, site, ISA 2000, SMS 2.0 Standard, Host Integration, Systems Management and Proxy servers.	General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE and AMES.*
Desktop software: Microsoft Academic Select - Office Premium 2000, Office Macintosh Edition 2001, Encarta Reference Suite, Visual Studio, Office Starts Here, Windows 32-bit operating system upgrades, Back Office Client Access Licence. Range of Microsoft Multimedia Titles. Multimedia CD-ROM.	General teaching and learning across the curriculum: project-based, inquiry-based, multi-tasking, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE and AMES.*
Internet.	Library and research. Government, Education Department Web sites. Development of education Web sites. Online learning/e-learning/distance learning: project-based, inquiry-based individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE, AMES. Private schools and private education providers.*
E-mail.	Communication between teachers, between teachers and students, and between students.	*Government primary and secondary, TAFE, ACE, CAE, AMES.*
Television transmission.	General teaching and learning across the curriculum.	*Primary and secondary.*
Radio transmission.	General teaching and learning across the curriculum.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*

*Technologies listed are used in Victoria (except those for the School of the Air). All states/territories throughout Australia use similar technologies. A national strategy for technologies, infrastructure, interoperability and online course content is currently being developed by The Le@rning Federation.

and young women are at risk of being excluded from the new and emerging jobs of the future as a result of inadequate ICT skills.

People with disabilities. ANTA's Bridging Pathways 2000–2005[9] is a Federal Government strategy and blueprint for increasing opportunities for people with a disability in VET. However, there is no ICT focus in the strategy. Many TAFE institutes throughout Australia conduct the vocational course Certificate in Work Education for special needs students. The course includes a core ICT subject.

Equity of access. The Victorian DET initiative Bridging the Digital Divide 2000–2002[10] provides AUD 23 million over three years for additional computers and networking to ensure equity of access to ICT for all students, regardless of socio-economic or geographic disadvantage. The Networking the Nation Project[11] assists educational development of rural Australia by funding projects that enhance telecommunications infrastructure and networks and reduce access disparities to telecommunications services and facilities. Some TAFE institutes conduct off-

campus courses in ICT skills at Certificate 1 and 2 levels, including courses for homeless and drug-addicted youth.

Nature and Roles of Partnerships

Existing ICT in education partnerships include those between all states/territories and between Australia and New Zealand. Examples of partnerships include the following:

- The Le@rning Federation:[12] an AUD 70 million initiative between all Australian and New Zealand Ministers of Education, to develop online interactive curriculum content, interoperability and infrastructure, to support teachers and enhance student learning.
- TAFE Frontiers:[13] a consortium partnership between TAFE, RTOs, AMES and ACFE.
- VET in Schools:[14] a partnership between TAFE and secondary schools for courses including IT and online courses.
- National Bandwidth Project:[15] partnerships between all Australian state/territory education sectors regarding national bandwidth standards.
- ICT in Schools Taskforce:[16] partnerships between all states/territories regarding ICT initiatives in education.
- Teachers of the 21st Century:[17] partnerships between federal and state/territory education sectors, teachers' associations, Catholic and independent schools.

Major initiatives

Table 2 provides examples of some current major initiatives across all education sectors.

Evaluation Reports of Major Initiatives

Whilst numerous discussion papers, strategic planning papers and implementation proposals exist for ICT use in education, thorough, long-term evaluations of ICT initiatives, projects and strategies are not always undertaken. Summary documentation of state/territory ICT initiatives is seldom available in an aggregated format. According to a spokesperson for The Le@rning Federation, many ICT in education projects are not evaluated as they are ongoing and "morph" or progress forward into the next phase of the initiative concerned. Following are a few examples of evaluations:

- Deakin University, 2002. "Evaluation of the Notebooks for Teachers and Principals Initiative." *www.sofweb.vic.edu.au/ict/notebooks/research.htm*. (An independent evaluation has revealed that in international terms this initiative has been groundbreaking. By June 2002, 91 per cent of all teachers and principals had a notebook computer. Nowhere else in the world has a government provided this level of support to its teachers and principals to assist them to integrate learning technologies into their daily working lives.)
- Learning Technologies Board, 2000. "Learning Networks Trial: Evaluation." Victoria: OTTE Publications. *www.otte.vic.gov.au/publications/LTLearningNetworks/index.htm.* (Evaluation of online learning networks as a vehicle for increasing choice and participation in VET through shifting the mode of educational delivery.)
- MCEETYA. 2002, 2003. "Learning in an Online World: The school education action plan for the information economy." Progress reports 2002 and 2003. Tasmania: MCEETYA ICTs in Schools Taskforce. (Unpublished progress reports on the implementation and integration of ICT in all schools, in order to improve operations and business practices, to improve student learning and to offer flexible learning opportunities throughout Australia and New Zealand.)

Provision of training

Current Examples

Training needs have been addressed by the introduction and implementation of a number of programmes in the primary, secondary and vocational sectors to encourage teachers to use ICT for teaching and learning. The following are some examples:

- The Notebooks for Teachers Program[18] provides notebook computers and ICT skills training for all teachers and principals in Victorian Government primary, secondary and TAFE sectors, to support the effective integration and use of learning technologies into the classroom and in administrative practices. Similar programmes are conducted in other states/territories.
- ICT Skills for Teachers[19] is an accredited training course for all TAFE teachers, providing the skills and knowledge required to enhance teaching and learning practices via the use of ICT technologies.

Table 2: Current major initiatives in primary, secondary, vocational and community education

Major initiatives	Delivery models	Sectors and partners
The Le@rning Federation: From 2001– 2006, a AU$ 70 million initiative to develop nationwide online interactive curriculum content for Australian and New Zealand schools, to support teachers, enhance student learning and improve educational outcomes. *(www.thelearningfederation.edu.au/tlf)*	Online learning via the Internet.	*Primary, secondary.*
Global Classroom Project: Australian and international schools have participated in a range of collaborative online projects over the past seven years. *(www.sofweb.vic.edu.au/gc/index.htm)*	Online, collaborative learning via the Internet.	*Primary, secondary Australian and international schools.*
Australian Flexible Learning Framework: World-class AU$ 20 million per year initiative to create and share knowledge about flexible learning and to support its take-up in the VET sector. *(http://flexiblelearning.net.au)*	Flexible learning, online learning via the Internet.	*VET.*
Mobile Computer Learning Libraries Program: AU$ 1.5 million project providing access to ICT training for ACE learners in remote locations in Victoria. *(www.otte.vic.gov.au/ettenews/issue5.htm#article5)*	Blended (face-to-face and online) delivery via 414 laptop computers in mobile libraries/labs.	*ACE in remote and isolated communities – regional, rural and urban.*
TAFE Virtual Campus: Victorian Government service for students to access over 800 fully accredited TAFE courses online and the WebCT learning management system (LMS). *(www.tafevc.com.au)*	Online learning and WebCT LMS.	*TAFE, AMES, ACE, secondary.*
Learnscope Project: Federal online professional development project for teachers focusing on ICT, flexible learning skills, e-learning and the application of new technologies for learning. *(www.learnscope.anta.gov.au/LearnScope/home.asp)*	Flexible delivery, online learning.	*VET.*
Wide Area Network: Victorian Government DET 2003– 2004 budget allocated AU$ 8 million over four years to give non-government schools continued access to the Internet via high speed, broadband telecommunications network. *(www.det.vic.gov.au/det)*	Infrastructure.	*Victorian Government and non-government primary, secondary.*
Interactive Distance E-learning Initiative: Federal Government AU$ 17 million project for a satellite network to cover the Northern Territory and parts of New South Wales for School of the Air classes in remote regions. *(www.dcita.gov.au)*	Distance learning using video cameras, electronic whiteboards and Web cameras.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*

- WebCT Training[20] provides training in the WebCT learning management system (LMS) and is conducted for teachers in TAFE, RTOs and ACE. Training is usually in-house, mixed-mode delivery of face-to-face and online.

- LearnScope[21] is a major national professional development programme for teachers, focusing on the application of new learning technologies to achieve more flexible learning in VET in the transition to the information economy.

Undergraduate and postgraduate teacher training courses throughout Australia include subjects and courses in the use of ICT in education. Courses such as Computers in the Classroom[22] are compulsory in Bachelor of Education courses. Specialist postgraduate certificate, diploma and master's courses have been developed in computer education with topics including computer ethics, computers in the curriculum, evaluation of curriculum software, ICT and the Internet, multimedia development, robotics, programming, and information technology resources for teachers. The Indigenous Education Strategic Plan 2000–2004[23] is a Northern Territory DET strategy specifying that teacher training programmes for teachers of Aboriginal students are to include ICT skills.

Recently trained teachers graduate with competent ICT skills, including multimedia software development skills for use in education. The training is effective and new teachers appear to be competent in, and comfortable with, the use of ICT in teaching and learning. However, some older teachers are largely lacking in ICT skills and require training. There appears to be reluctance on the part of this cohort to adapt to and adopt the use of new technologies in education.

Future Training Needs

Currently, further incentives are needed in education environments to encourage some older teachers in the primary, secondary, vocational and community education sectors to acquire ICT skills. Recognition of ICT skills as "advanced" in terms of promotion and/or higher remuneration is perceived as an encouragement. For example, the Tasmanian DET's ICT in Education (K12) Strategic Policy 2002–2005[24] states that all staff in school leadership positions will demonstrate competence and ongoing commitment to developing skills in the use of ICT in teaching and learning as a requirement for promotion.

Constraints on the use of ICT

Rural and Remote Regions

Australian telecommunications infrastructure and access have been constraints in rural and remote regions. The independent report, "Regional Telecommunications Inquiry: Connecting Regional Australia,"[25] made a number of recommendations for improvements. However, the Interactive Distance E-learning Initiative has been introduced to alleviate the challenges associated with the use of ICT in education in remote locations.

National Policy on Infrastructure, Inter-operability and Course Content

Constraints occur between federal and state/territory governments in relation to national policy development for the use of ICT in education. In the past, it has been difficult to implement nationwide policies and strategies regarding bandwidth standards, infrastructure, inter-operability, online course development, learning managements systems, etc. The Le@rning Federation projects and initiatives have been developed in response to these constraints.

Constraints also exist in relation to the use of ICT in education for indigenous Australians, women, people with disabilities and older Australians.

Analysis

Overall, current Australian federal and state/territory policies, plans, strategies and initiatives for ICT in education are well conceived and progressive. However, there is a need to more fully address how the use of ICT in education might benefit various groups:

- Aboriginal students in a context harmonious with their indigenous cultural beliefs.
- Students with disabilities and/or impairment also require improved access to ICTs via modified hardware and software applications.
- Further strategies are required to encourage older Australians and women to engage in ICT education, perhaps via informal, low-cost training conducted at convenient local venues, or via the extension of the mobile computer lab/library initiative.
- A comprehensive, national project to provide low-cost/no-cost computer hardware and software – recycled from industry/commerce – to Australians from low socio-economic backgrounds would break down the "digital divide" between computer owners and non-owners. This would enhance access to ICT and its use in education for all students regardless of income levels.

APPENDIX 1

Glossary of acronyms

ACE: adult community education
ACFE: adult community and further education
AMES: Adult Multicultural Education Services
ANTA: Australian National Training Authority
AQF: Australian Qualifications Framework
BITES: Basic IT Enabling Skills (for Older Workers)
CAE: Council of Adult Education
DET: Department of Education and Training
ICT: information and communication technology
IT: information technology
LMS: learning management system
MCEETYA: Ministerial Council for Education, Employment, Training and Youth Affairs
OTTE: Office of Training and Tertiary Education
RTO: registered training organisation
TAFE: technical and further education
TLF: The Le@rning Federation
VET: vocational education and training

NOTES

1 "Indigenous Education Strategic Plan 2000–2004." *www.education.nt.gov.au.* Northern Territory DET's plan for indigenous education. Equity in ICT education.
2 "Aboriginal Education Policy 1996 and Review 2001–2005." *www.schools.nsw.edu.au.* NSW Department. of School Education policy regarding ICT to meet the learning needs of Aboriginal students. Equity in ICT education.
3 Basic IT Enabling Skills (BITES) for Older Workers. *www.itskills.dest.gov.au.* Provides workers aged 45 years and older with the opportunity to train in IT/ICT skills. Equity in ICT education.
4 University of the Third Age (U3A). *www.u3acanberra.org.au.* Australia-wide education for older Australians. Equity in ICT education.
5 Council of Adult Education (CAE). *www.cae.edu.au.* Largest provider of adult and community education programmes in Australia, including ICT and IT training and courses. Equity in ICT education.
6 Girls and ICTs Initiative. *http://education.qld.gov.au/itt/learning/html/girls-ict.html.* Queensland Government initiative for girls and ICTs. Equity in ICT education.
7 Ministerial Council on Education, Employment, Training and Youth Affairs and Curriculum Council, *Ministerial Declaration on*

Adult Community Education (Victoria: Department of Education and Training, 2002). *www.curriculum.edu.au/mctyapdf/ace_declaration.pdf.*
ICT courses and training for adults and women in ACE. Equity in ICT education.

8 Women's Web Project. *www.womensweb.org.au/pages/default.cfm?page_id.* Equity in ICT education.

9 Bridging Pathways 2000 – 2005. *www.anta.gov.au.* Australian National Training Authority (ANTA) federal strategy and blueprint for increasing opportunities for people with a disability in VET – no specific ITC strategies.

10 Bridging the Digital Divide 2001 – 2002. *www.sofweb.vic.edu.au/ict/bdd/index.htm.* Victorian DET initiative provides AUD 23 million over three years for additional computers and networking. Equity in ICT education.

11 Networking the Nation. www.dcita.gov.au/Article/0,,0_1-2_3-4_106337,00.html. Federal programme to assist the development of rural Australia via projects, which enhance telecommunications infrastructure and services and increase access to services via telecommunications networks. Equity in ICT education.

12 The Le@rning Federation. www.thelearningfederation.edu.au/tlf. A 2001–2006 AUD 70 million initiative for online course, infrastructure and interoperability development. Partnerships between Australian state/territory and New Zealand governments.

13 TAFE Frontiers. *www.tafefrontiers.com.au.* Peak body supporting registered training organisations (RTOs) within the Victorian VET sector to implement flexible learning. Partnerships between TAFE, ACE and private providers.

14 VET in Schools Program. *http://online.curriculum.edu.au/the_cms/tools/new-display.asp?seq=-9&industry=Vetis.* VET resources developed to assist in the implementation of vocational training packages in schools. Partnerships between VET and secondary education sectors.

15 National Bandwidth Project. *www.noie.gov.au/Projects/environment/bandwidth.* Major Commonwealth Government study into the likely availability and price of bandwidth in Australia. Partnerships between all Australian states/territories in all education sectors.

16 ICT in Schools Taskforce. *www.aictec.edu.au/advisory/reports/ictst/default.htm.* Major national collaborative, advisory and advocacy group on the use of technology in school education and the development of national services such as EdNA Online. Partnerships between all Australian state/territory education departments and non-government school sectors.

17 Teachers of the 21st Century. *www.qualityteaching.dest.gov.au/Content/Item_282.htm.* Commonwealth Government initiative to improve teacher quality, increase the number of highly effective Australian schools and maximise student learning outcomes. Partnerships and teacher training (including training in ICT).

18 Notebooks for Teachers Program. *www.sofweb.vic.edu.au/ict/notebooks.* Notebook computers and ICT skills training for all teachers and principals in Victorian government primary, secondary and TAFE sectors. Teacher training.

19 ICT Skills for Teachers. *www.tafevc.com.au/ict/htm/resources.htm.* An accredited training course for all TAFE teachers, providing the skills and knowledge in the use of ICT technologies. Teacher training.

20 WebCT Training. *webct.com*. Training in the WebCT learning management system for teachers in TAFE, RTOs and ACE. Teacher training.

21 LearnScope. *www.learnscope.anta.gov.au.* Major national professional development programme for teachers focusing on the application of ICTs and flexible learning in VET. Teacher training.

22 Computers in the Classroom. *www.unimelb.edu.au.* Subject taught in undergraduate teacher training courses such as the Bachelor of Education (secondary and primary) in the Faculty of Education, at University of Melbourne. Teacher training.

23 Indigenous Education Strategic Plan 2000–2004. www.education.nt.gov.au/pages/indigenous.shtml. Northern Territory DET strategy specifies that teacher training programmes for teachers of Aboriginal students are to include IT skills.

24 ICT in Education (K12) Strategic Policy 2002–2005. *http://connections.education.tas.gov.au/Nav/StrategicPolicy.asp?ID=00000145 24.* Tasmania DET strategy for the implementation of ICT in education.

25 "Regional Telecommunications Inquiry: Connecting Regional Australia." *www.telinquiry.gov.au/rti-report.html.* Report developed for the Commonwealth Government by the independent Regional Telecommunications Inquiry.

Cook Islands

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Cook Islands comprises 15 islands with a land area of 240 square kilometers, spread over 2.2 million square kilometers of sea. The population of 20,407[1] is bilingual (Cook Island Maori and English). Rarotonga is the main island with the parliament, government department headquarters and the main commercial centre. Politically, the nation is self-governed but in close association with New Zealand. Parliament comprises 24 members elected every five years. The Cook Island economy is based on the export of some agricultural produce, handicrafts and tourism. The currency used

is the New Zealand dollar. Cook Islands is a member of the regional University of the South Pacific (USP), and hence is part of the privately owned satellite system called USPNet.

National policies, strategies and programmes

ICT Policy and Budget

The Cook Islands information and communication technology (ICT) policy framework is currently at the writing stage. The target date for completion is December 2003. As understood, the framework will follow the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan (PIIPS), a regional ICT strategy agreed and signed by the Communication Ministers of each respective Forum member country.

ICT development is still haphazard and currently led by the private sector. The government sector is a consumer at this point rather than an instigator of development.

The budget allocation for ICT development is about US$ 59,000[2] under the Prime Minister's Office. However, the policy analyst interviewed for this report emphasised that the amount is set aside for policy development only. Other funding sources have been identified but are awaiting official confirmation.

Cook Islands ICT Committee

The ICT Committee was established in March 2003 and chaired by the prime minister who also holds the portfolio for telecommunication. The committee members are representatives of the Ministries of Finance and Education, one from the Office of the Prime Minister, and representatives from the tourism, telecommunication and computer services sectors. The current mandate for the committee is to advise government on ICT matters and develop a strategic plan to promote national awareness of ICT issues.

Current level of ICT access and use

Connectivity

As of 2003, Telecom Cook Islands (TCI) reported that there are 6,180 telephone lines connected relative to a population of 13,400. That is, approximately 46 per cent of the population has access. Mobile customers have reached 1,499 and 1,200 Internet customers. Internet connection is currently available only in Rarotonga, Aitutaki and Mangaia and serviced by a single Internet service provider, Telecom's *oyster.co.ck.*

Telecom's Internet backbone connectivity is provided from two independent sources: Teleglobe in Canada (PITANET) and Voyager in New Zealand. TCI claims that international access is very expensive because of satellite and access costs.

E-mail

Public schools connected to the Education Network (EduNet) have e-mail facilities. EduNet is a partnership between the Ministry of Education and Telecom Cook Islands (TCI). The overall vision of the EduNet project is to provide schools and the Ministry of Education with the technology that will facilitate distance education goals. To quote directly from the proposal "the completion of the project will enable the Ministry of Education to conduct and deliver its Distance Education programmes in a timely and effective way, supported by the establishment of a Distance Education Centre for the explicit purpose of writing and producing course programmes and resources suitable for Cook Islands conditions."

TCI will install as well as manage the telecommunication network for this project. The initial phase was implemented on Rarotonga in late 2000 and some form of training has been conducted to facilitate access for all the schools connected to the network. There is still a long way to go. The United Nations Development Programme (UNDP) has expressed interest in funding the project; however no confirmation has been received. The official update of the project will be available in December 2003. However, EduNet only offers a single mailbox for each school, and the school principal and another trained staff are the only ones with access to the network. Extending e-mail facilities to the staff in public schools is currently in development.

Private schools with Internet connection also have access to e-mail, but on a very limited basis because of costs.

USP students in Rarotonga have access to e-mail and Internet facilities through USPNet. The establishment of USPNet in its current capacity (e-mail access and teleconferencing capability) has made it possible for students of the Cook Islands to complete a significant proportion of their programme without leaving their families and work opportunities. They are now beginning to utilise this technology to submit drafts and final copies of assignments, communicate with lecturers and course co-ordinators and access online USP courses, particularly in Law. A number of students have taken up this opportunity while the others still need to learn and feel confident in using the technology.

The multimodal facility of the network has provided different modes of learning experiences for the students that include learning from the printed study materials, videoconference tutorials with the lecturer in Fiji and online courses with lecturers based in Vanuatu. There are also audioconference tutorials to support these modes. The different learning modes are beginning to infuse the students with a sense of belonging, forging a spirit of camaraderie within the student population.

The next phase is to make the technology work in the outer islands so that the students there will benefit from the same experience as the students in Rarotonga. Students are advised to fill in a form designed for setting up an e-mail address. Some students also have access to e-mail at work or home. Students studying Internet and video broadcast courses also have access to WebCT, a platform by which they can interact with their lecturer, tutor and other students.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students in Rarotonga only. Students who are enrolled in accounting, information systems, tourism and psychology are the frequent users. Psychology students who are using the videoconference mode find this technology a good substitute for a face-to-face session because it allows for interaction in real time compared to the video broadcast mode. Audio and video teleconference sessions are scheduled daily throughout the week in support of all distance and flexible learning courses of the university. Tapes of video broadcast sessions and audio conference tutorials are sent to USP students in the outer islands.

Internet/World Wide Web for Education

Primary and secondary schools do not have full access to the Internet. Access is subject to the school's financial ability to absorb costs. Instead, some students have access to the Internet through private connections at home or at a parent's workplace. For example, a number of students at Nukutere College, a Catholic school who are familiar with the technology, use the World Wide Web to research school assignments.

USP students are beginning to utilise the web for their research, and download reference materials for their assignments. However, there is still a need to develop confidence in using different search engines, doing advance searches and using electronic libraries and databases.

Some secondary and USP students in the outer island of Mangaia can now access the Internet and use e-mail. Mangaia College, which has a suite of 15 work stations, has just recently been connected to the Internet, which will help USP students and tutors get in touch with the USP Centre in Rarotonga as well as course lecturers at the Suva campus. It will cost Mangaians about US$ 0.10 per minute to access the Internet.

On Rarotonga, examples of Internet use include research for children's assignments and downloading music and games.

Telephone and Facsimile

Telephone and fax are the most common form of communication within and across the islands. Public and private schools, households and organisations have access to telephones and facsimile in Rarotonga and the southern and northern group islands. There are currently about 409 fax machines in the Cook Islands, with 314 in Rarotonga alone.

Computer Use

Learning to use computers for primary and secondary students is incorporated into the school curriculum. Previously called Text Information Management (TIM), the course is now called Information Communication Technology. The course syllabus is currently limited to learning or familiarising students with Microsoft software such as Word, and Excel. Lack of knowledge of curriculum developers and teachers limits full incorporation of ICTs into classroom activities or learning.

Most of the schools in Rarotonga and some outer island schools such as the colleges in Mangaia and Atiu, Aitutaki and Mauke have computer suites with a number of work stations. Secondary students are enrolled in computing courses through the Correspondence School in New Zealand. Teacher trainees also have access to computers within the school for word processing use.

Broadcast Technologies

There are two radio stations in the Cook Islands: Radio Cook Islands and the privately owned KCFM station, established in 1979. KCFM Radio operates only in Rarotonga while Radio Cook Islands broadcasts can be heard in the southern and the northern group islands up to Penhryn. Programmes on both radios are typical and have no educational content. However, Radio Cook Islands announcers utilise time slots for talkback shows to discuss and get opinions from its audience on current issues affecting the country. These talkback programmes are now considered by politicians as a feedback mechanism for the people's reaction to government policy and activities especially as the general election is looming in 2004. There is a plan to utilise radio for a health-related initiative – an information/education campaign targeted at young people on the effects of tobacco.

Cook Islands Television went on air in 1989 and was owned at the time by Cook Islands Broadcasting Corporation, which also owned Radio Cook Islands. After the economic downturn in 1996, the government decided to privatise assets as part of the structural reform programme. Both Cook Islands TV and Radio Cook Islands are now leased to Elijah Communication. Cook Islands Television has only one channel and is viewable only in Rarotonga.

Major initiatives

EduNet

The initial phase in the implementation of the Education Wide Area Network Project (EduNet) in 2000–2001 involved the establishment of the Rarotonga intranet. All primary and secondary public schools are connected to the network. The technology allows e-mail and file-sharing facilities for government schools in Rarotonga connected to the EduNet server located at the Ministry of Education site. Computer sites in schools are able to connect to the server through a dial-up system.

The EduNet service acts as a self-contained extranet but is not connected to the Internet. In this initial phase it acts as a mail server and file server that distributes e-mail, data files and course programmes. It also provides file access and sharing facilities over the network and centralised backup facilities. Schools connected to the network have only a single mailbox. E-mail facilities for the staff are still in development.

Generally, access to the EduNet service is currently limited to school administration and staff. Also in the pipeline is the creation of a website to enable students to have access to the site as well.

Telehealth

The Telehealth project is a partnership between the Ministry of Health and Telecom Cook Islands. The project will use the Internet and e-mail to facilitate medical diagnosis and assistance from specialists in Rarotonga to health care workers in the outer islands. Initial training on the software template was conducted by Telecom early this year. This project is still in its initial phase of implementation.

World Health Organization/USP HealthNet

This initiative, a partnership between the World Health Organization (WHO) and the Ministry of Health/USP, will facilitate ICT access for all medical staff in the region. The project involves education and training on the use of the Internet for research and accessing relevant information from WHO for health alerts and other information. The project also involves infrastructure management. In the Cook Islands, this ICT training is envisaged to be part of the student nurses training programme. The initial training for trainers was planned to commence in September 2003.

Outer Islands Network Upgrade

Telecom Cook Islands (TCI) announced an upgrade to the outer islands network early this year. This upgrade will enable the outer islands to have access to the Internet and e-mail. Mangaia College on Mangaia Island and an accommodation business were the first establishments on the island to connect to the Internet.

Digital Cellular Network

Koka Net cellular network, owned by Telecom Cook Islands, has announced the upgrade of its cellular network from an analogue to a digital system. TCI has a current listing of 1,499 mobile customers connected to the Koka Net. This represents a threefold increase in the number of customers with cellular phones.

Examples of training

Computer Training for the Outer Islands

The USP Centre is currently involved in facilitating pre-degree computer training in the outer islands in association with the National Human Resources Development. This is a high school or Level 2 programme in the New Zealand Qualification Framework. As well, secondary students on Mangaia, Aitutaki and Atiu are doing Level 2 computing through the Correspondence School of New Zealand.

Teacher Training

In 2001, the principal and one staff from each school who was familiar in using computers were given training so each school could log onto the EduNet server and download their e-mail and other information. The trainer was the system administrator running the programme; however, when the system administrator left the ministry, the project slowed down and encountered a number of technical problems.

Telecom also offered some training in using Internet to those schools with Internet connections.

NHRD Computer Training

The National Human Resource Development (NHRD) has funded a computer-training programme to improve the skills of women in the labour force who wanted to change careers and increase their employability. The course offered was a National Certificate in Business Administration Level 2 on the NZQA Framework. It was available only to women in

Rarotonga. Training sites were located at secondary schools that have a large number of work stations available.

Other Computer Training for Young People and Adults

Training in the area of basic PC maintenance, programming and software use was initiated by private training establishments. This type of training is usually conducted during the school holidays with the target group being young people.

Computer literacy and ICT training are mostly done on the job and some training needs were addressed but not in a planned effort. It is hoped that in the setting up of the ICT policy framework, the level of ICT skills in the country can be assessed to provide direction and identify future training needs in all sectors.

Constraints on the use of ICT

The following constraints were identified by participants at the Cook Islands ICT workshop held in June 2003.[3]

- Telecom monopoly: exclusivity agreement not up for discussion until 2006;
- High cost of access: both Internet and toll calls;
- Cost of developing the national ICT infrastructure: lack of economies of scale and high Internet and bandwidth costs;
- High cost of hardware and software;
- Maintenance and replacement costs of hardware due to the harsh environment and unstable electricity level;
- Need for in-country training on ICT including training at all levels of education and sectors;
- Lack of government policy and political will; and
- Good governance issues.

Analysis

While the Cook Islands ICT policy framework is still in the development stage, the country is more advanced compared to many other Pacific countries. This is likely due to the close association with New Zealand and the regular infusion of trained personnel as they complete studies and return to the island country. Further, there was a major government reform of the public service in the mid-1990s and it is assumed that the public service workforce is now working with improved commitment and attitude. Connectivity exists throughout the islands, and schools have all been linked through the EduNet project. The long-established broadcast technologies have developed more and are now moving into educational programmes. However, there remains a need to mount training programmes that will ensure sustainability of trained expertise. In particular, there needs to be an ongoing programme to ensure teachers are oriented and trained before they enter the service.

NOTES

1 From the Census 2001, Statistics Office.
2 From the Budget 2003-2004.
3 "ICT for the Cook Islands," Cook Islands National ICT Workshop Report, June 2003. Participants of the ICT workshop in June 2003 included staff of the different government ministries/departments; ad hoc bodies such as tourism, environment and the police; the private sector such as Telecom Cook Islands, computer businesses, Cook Islands Television and Cook Islands News; island secretaries from the north and southern groups; and NGOs such as WWF, Cook Islands Association of NGOs (CIANGO) and National Council of Women.

Fiji

ICT USE IN EDUCATION

Ms Salanieta Bakalevu, Ph.D
Mr Anare Tuitoga

BACKGROUND

Education

Education in Fiji is a partnership between government and the communities. The government pays a large proportion of teachers' salaries and provides grants while school committees manage the financial operations of the facilities and infrastructure. Of the total 700 primary schools only two are government-owned, and of 156 secondary schools, 12 are government-owned. Committees manage the rest. While this unique partnership in the management of schools

promotes a sense of identity and common purpose, it also has a bearing on critical choices that schools make, such as the utilisation of new technologies. After all, technology (and maintenance) is not cheap.

Information and communication technology (ICT) in education in Fiji is still developing, and its potential is yet to be felt. At the Ministry of Education (MOE), a network system is being established, a Ministry website is under development and Internet and e-mail access is limited. While about half of all secondary schools have computers, only a few of the larger ones in urban centres have Internet and e-mail access, and fewer still have their own websites.

Telecommunications

Fiji's domestic telecommunications industry comprises three companies that are partly privatised and partly publicly owned. They operate as monopolies under exclusive licence arrangements. All companies are owned by ATH of which the government is a major shareholder.

Internet access and use is still developing. Currently there is one Internet service provider (ISP), which provides dial-up connections via traditional telephone lines and, more recently, over digital ISDN lines. However, the ISDN is available only in the capital, Suva, and at a cost that puts it out of reach of most except large businesses. Until recently no Internet access was available in those parts of the country where there are no telephone lines or where the lines are of poor quality. Access to the various high-speed options (broadband access) that is widely available in more developed countries is limited to the larger organisations like USP that have higher traffic and capacity. Despite the limits on Internet access, most organisations have embraced the World Wide Web enthusiastically.

National policies, strategies and programmes

ITCS is the official government department for providing information technology services, which include policy formulation and expert advice, systems development, information technology infrastructure building and management, training and customer support. The government is committed to developing the ICT industry including e-governance. It is also aware of the current monopolistic framework for telecommunications and is intent on making the industry more efficient.

Government Strategic Plan

The ICT goal in the Government Strategic Plan[1] is "universal access to internationally competitive ICT services." This goal transfers into the policy objectives that include the reduction of telecom rates in the short term by promoting more dialogue between investors and providers to negotiate favourable rates; increased coverage of telecom services, especially to rural areas; liberalisation of the telecom sector through more competition and the removal of exclusive licences; alignment of ICT training to developments in the employment market; and the introduction of e-government for greater efficiency of service.

Performance indicators include: the reduction of telephone charges and removal of exclusive telecom licences by 2005; increased competition with more ISPs; telecommunication access to at least 400 more unconnected villages by 2005; quality standards; an additional 10 schools per year with computers and Internet access and corporate sponsors provided for additional schools; upgrading of computer skills of teachers; adoption of ICT employment skills training modules by information technology training providers; and integration of e-government.

Ministry of Education Strategic Plan

Limited links to education facilities is noted in the eGovernment Strategic Plan.[2] A priority of Year 2 (2004–2005) of the plan is to focus on information technology infrastructure for education to include links to schools and database implementation. This operation is estimated to cost FJD 1 million.

Objective 9 of the MOE Strategic Plan deals specifically with the exploration and use of technology. It includes plans for establishing network systems for the ministry, as well as information technology centres and distance education centres at strategic locations. These will, respectively, offer ICT services and provide support for teaching and learning in schools.

Regional ICT Centre

USP, working with the Fiji government and JICA,[3] plans to lessen the digital divide by establishing the PCIT, which is expected to play a leading role in carrying out a variety of activities for human resources development in ICT throughout the Pacific region. Because of USP's strategic location in Fiji, the benefits of this venture for the country are great.

Current level of ICT access and use

Telecommunication Services

The amount of traffic/telecommunications capacity at all schools and teacher training institutions is fairly small. Thus the telecommunication service used is either a "thin route"

or "medium route" network. USP's larger capacity and services use broadband networks.

Radio Broadcast

Radio broadcast has a long history in education and remains the most accessible medium for reaching remote rural communities. While most programmes are generally educational, especially those in the local languages, two programmes deserve mention. The first is a daily broadcast for primary schools that is prepared and recorded at the Schools Broadcast Unit and transmitted through Radio Fiji. The programme includes lessons for primary students as well as discussion forums for teachers. The second is developed and transmitted through Radio 95.2 FM of CETC,[4] the training arm of the SPC in Suva. CETC is a regional institution for women committed to community development, and Radio 95.2 is an extension of its training in radio programming and broadcasting.

The challenge for radio broadcasting is to improve transmission (replace old AM transmitters of limited reach) and design more effective programmes. While radio will remain for many more years, the technology is moving to digital broadcasting and Internet radio.

Audiovisual Aids

The Schools Broadcast Unit is a mini media centre for the MOE. It prints learning materials and other documents for schools, and also produces audiovisual aids including audiocassettes, videotapes and CD-ROMs that schools can borrow.

TV Transmission

TV transmission includes the majority of the population, and a modern Free-to-Air (Fiji 1)[5] service reaches most homes. However, its use for specific learning purposes is limited. A few programmes such as *Get Set* for younger viewers; *Dateline,* produced by the Government Film & TV Unit; *Pacific Way,* produced by the Media Centre of SPC; and weekly programmes of the Fijian and Hindi-language cultures and traditions serve important educational purposes for all viewers.

Computer Studies

Computer Studies[6] is an optional subject in forms 5, 6 and 7, but it is yet to make an impact. Only 86 (55 per cent) of all secondary schools take this option. Of these, only 35 have Internet connections.

While there is no curriculum for computer studies below form 5, a few have developed their own for forms 1 to 4. To the best of our knowledge, only two primary schools have computers and do some computer studies. Most schools that offer computer-related studies are located around the major urban centres and funded by Indo-Fijian organisations. This situation reflects the constraints of resources – physical, financial, and human.

Internet

Twenty per cent of schools have Internet access, mainly for the use of teachers. While most schools have more than 10 computers, a few have small LAN networks with a server facility for sharing information and Internet services. Meanwhile, Internet access at teacher training institutions (apart from USP) is poor. The major teacher training institutions have no systems network, only standalone terminals with a dial-up facility in libraries for the use of lecturers and trainees. The major TVET institutions have good Internet access that is used by staff and students to source information and for research. None of the mentioned institutions use Internet for online teaching or WebCT. However, Nadi Muslim College stands out with its most advanced technologies and services in learning, thanks to a private donation.

An overview of the technologies being used in schools, technical/vocational institutions and in non-formal education is provided in Table 1. The differences between the applications in secondary schools and the tertiary level are noteworthy.

Equity issues

While NGOs remain the strongest advocates of equity issues, the government has also instituted policies and strategies along the lines of EFA requirements.[7] However, for obvious reasons, specific ICT focus in equity initiatives is, as yet, minimal.

Indigenous Fijians

Under its comprehensive Blueprint for Affirmative Action on Fijian Education, the government plans to create opportunities and pathways for the improvement of Fijian education. One initiative is the development of information technology and related infrastructure in Fijian schools, which includes the purchase and maintenance of hardware, software and provision of Internet facilities.

Rural Communities

Rural development is a high priority of the government. Rural electrification, improved telecommunication services, and SME training are some of the initiatives underway. NGOs, the private sector and international organisations are also actively involved. Most business houses, including banks, insurance companies and retailers, have community outreach projects with a strong focus on education.

Table 1: Summary of technologies being used (primary, secondary, TVET, non-formal)

Type of technology used	Use of the technology	Sectors using the technology
Radio Broadcast SBU: Recording studio: analog & digital - convertible system CETC: Radio studio with station (FM 95.2): digital	Record programmes on digital audiotapes and sent to Radio Fiji for teaching and learning in schools Training in radio programming and broadcasting	*Primary schools (10– 12 a.m. daily), and primary & secondary teachers* *Vocational/community training for women - regional*
AV Library Service (SBU) Beta cam system; moving to digital system & software	Burn CDs, produce videotapes.	*Primary & secondary school resources*
TV transmission	Teaching & learning Sharing information & knowledge	*Younger viewers* *General public*
Hardware: desktop computers, printers, network systems, power supply	Teaching & learning, especially Curriculum Studies classes. Word: projects, group work, inquiry	*55% secondary schools doing Computer Studies in forms 6 & 7; three primary schools. Teacher training-most.* *TVET- FIT, SPC, TPAF, APTECH, etc.*
Server software: Windows 2000	Teaching & learning services	*Not in the schools; Teacher training: only USP.* *TVET: FIT, SPC, TPAF and few others.*
Desktop Software: MS Office 97 CD-ROM	Teaching & learning especially curriculum studies classes. Word: projects, group work, inquiry	*86 secondary schools doing Computer Studies in forms 6 & 7; three primary schools. Teacher training-USP, limited in others;* *TVET - most use it*
Thin route or medium route telecommunication application	Low-speed/medium-speed networking. Limited to basic services as per requirement: communication, inquiry and research	*Most schools, TVET and teacher training (except USP); rural centres*
Internet	Library & research; inquiry & project-based learning; development of Web sites	*In schools-mainly for teachers' use. TVET, teacher training (USP, FCAE)-for all*
E-mail	Communication between school and outside and teachers	*Schools-mostly restricted to teachers' use*
High-speed broadband telecommunications network	High-speed networking. General teaching and learning across the curriculum WebCT; distance learning	*Teacher training-USP (USPNet)*

Assistance through donations of stationery and computer hardware has been prominent.

Women

A survey of the 86 schools that teach Computer Science in forms 5, 6 and 7 shows comparable participation of both genders (54 per cent female). Of the teachers who teach Computer Science, 41 per cent are women. Meanwhile at the Ministry of Women, Social Welfare and Poverty Alleviation, an ongoing project on Women in Science and Technology currently has two subprojects: Women in Fisheries, which is being developed in conjunction with USP and SPC, and Women in e-Commerce. The latter is a new venture aimed at empowering rural women and facilitating entrepreneurial skills. A series of activities including identifying producers, comprehensive training in information technology and SMEs, support for production, identifying primary and secondary markets and establishing simple mobile systems of operation are part of a pilot project.

People with Disabilities

All education and training for people with disabilities is managed by NGOs with the government providing teachers and trainers. The main schools have computer laboratories that students have access to. Hilton School for the Disabled has prevocational courses which prepare students for further studies or employment. Despite a constant lack of funding, the services have been very successful.

Youth

Small and micro enterprises in the informal sector are the current priority of youth training and development. A database of needs, capabilities and resources is being compiled. A pilot project in rural banking, among others, is being trialled.

Major initiatives

Telecommunications Infrastructure

The infrastructure capacity via the new Southern Cross Cable Network that links Fiji to Australia, New Zealand and the United States has provided a greatly expanded capacity for data traffic. The network has the impetus for bridging the digital divide and optimising the country's opportunity in transmission.

Modern telecommunication services will shortly be open to rural and outlying islands through projects currently being undertaken by TFL.[8] These include:

- An expansion of the current EasyTel service, a wireless local loop telephone service that is delivered by the CDMA technology.
- A FJD 45 million satellite project that will, over the next 10 years, see rural people receive the full complement of services and solutions available to customers in the urban centre.
- A joint effort with government will see telecentres provide "public" access for learning. (Three centres will be operational by December 2003 and will be in place by the end of the initiative. As far as possible, the centres will operate from schools but will be accessible to communities.)

Computer Studies Curriculum

A project to evaluate the current Computer Studies curriculum was recently completed. The report provided important information that the MOE can use in its revision. The recommendations for the revision include these needs: greater practicality, provision of appropriate laboratory and Internet access, incorporation of the needs of industry and ongoing training for teachers.

Capacity-building

- **Education and training in ICT** are being offered by many institutions including USP, FIT, and TPAF. This is a competitive area of training and there is a wide range of courses at all levels. The quality of courses is very high.
- **ICT in teacher training** for secondary teachers is already in place in USP's degree programmes for secondary teachers. Next year similar information technology streams will be included in primary teacher training at Lautoka Teachers College and USP.
- **Train the Trainers for ICT Skills in Secondary Education** is an ongoing project that funds overseas training in information technology for teachers. Beneficiaries have formed networks and associations for knowledge-sharing, capacity-building and empowerment.
- **General training by Telecom and ITC,** in the form of short courses and workshops, is run for different client groups. For example, to make the telecentres work, training will be provided for the communities.

Constraints on the use of ICT

- **Lack of infrastructure and facilities:** Many schools lack infrastructure and facilities to support ICT. Poor classrooms, limited electricity supply and poor telecommunication links are major problems.
- **High costs:** The cost of computers and peripherals as well as maintenance and transmission are borne by school committees. It is an expensive exercise.
- **Lack of knowledge and skills:** ICT knowledge and skills are in demand in schools. Currently, only 40 per cent of those teaching Computer Studies have an ICT background or qualification; most are either mathematics or accounting majors. A related problem is the lack of expertise for repair and maintenance of technology connections.

Analysis

The government has a strong national ICT plan that will unfold over the next 10 years. However, the plans to liberalise the telecommunications sector and make it more efficient and affordable for users must come sooner rather than later. Exorbitant Internet charges by the monopolistic power of the telecommunications industry have neither commercial reason nor educational sense. The charges put the technology beyond the reach of ordinary citizens, including schools and small businesses, and deprive people and the country of the benefits of the cyber world. There is a very strong feeling nationwide on this issue.

Capacity-building is another important element of the project. The development, upgrading and provision of

infrastructure and technological hardware go hand in hand with ongoing training for potential users. While it is expected that schools will be able to sustain ICT use, it is the non-formal sector that will need monitoring and support. The fast pace of technological advance makes this urgent. Government (in collaboration with other providers) needs to establish new units or restructure other services for this. Otherwise, the burden will continue to fall on schools to serve as the primary agency of support.

The MOE needs a comprehensive plan to provide the roadmap for a more systematic development of ICTs in Education.[9] The plan, which should cover policies and strategies that relate to issues such as inequality, ICT literacy, costs, software, teacher training and rewards, needs to be holistic. How soon the ministry wants to get into distance education is also an important factor in this development. The government-telecom initiated telecentres, expected to be operational soon, may well provide the impetus for the MOE's planned information technology and distance learning centres. Indeed, the telecentres could provide a "home" for such services. Co-ordination of strategies and sharing of resources will be important to avoid duplication, save unnecessary costs and speed up the processes – to benefit schools and the wider communities.

APPENDIX 1

Glossary of acronyms

ATH: Amalgamated Telecom Holdings
CDMA: code division multiple access
CETC: Community Education Training Centre
EFA: Education for All
FIT: Fiji Institute of Technology
FCAE: Fiji College of Advanced Education
ISDN: integrated services digital network
ICT: Information Technology and Communication
ITCS: Information Technology and Communication Services
ISP: Internet service provider
JICA: Japan International Cooperation Agency
MOE: Ministry of Education
NGO: Non-government organisation
PCIT: Pacific Centre for Information Technology
SBU: Schools Broadcast Unit
SME: small and micro enterprise
SPC: Secretariat of the Pacific Community
TFL: Telecom Fiji Limited
TVET: Technical Vocational Education and Training
USP: University of the South Pacific
TPAF: Total Productivity Authority of Fiji

NOTES

1 "Strategic Developmental Plan: 2003–2005," Parliamentary Paper No. 72 of 2002, *www.itc.gov.fj/publications.html#sdp.*
2 "eGovernment Strategic Plan," Working Document, *www.itc.gov.fj/docs/Data3eGovtStrategicPlan.pdf.*
3 "ICT Capacity-Building at USP," www.usp.ac.fj/jica.
4 For information on courses offered, see *www.spc.int/cetc/CourseOffered.htm.*
5 See Fiji TV, *www.fijitv.com.fj.*
6 E. Williams, M. Kato and N. Khan. "Evaluation of Computer Science Curriculum in Fiji Secondary Schools" (USP: 2003).
7 "Education for All: Country Report Fiji" (UNESCO, 2000), *www2.unesco.org/wef/country reports/fiji/contents.html.*
8 See "More Rural Areas Connect," *www.telecomfiji.com.fj*.
9 E.B. Williams, "Information Technology and Distance Education" in *Learning Together: Directions for Education in Fiji. Report of the Fiji Islands Education Commission/Panel* (Suva: Government Printer, 2000).

Kiribati

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Kiribati is situated across the equator, north of Fiji. It consists of 33 islands spread over 5 million square kilometres of sea with a total land area of 717 square kilometres. Of the 33 islands, 21 are inhabited with a total population of 91,985 (2002) that is primarily I-Kiribati. The islands are low-lying and many enclose a lagoon.

Kiribati is a member of the Commonwealth and was originally under British rule until it gained independence in 1979. There is a

legislative assembly (called Mangeaba-ni-Maungatabu) of 36 members, elected every four years. Official languages are I-Kiribati and English. The main island is Tarawa, which has the seaport and airport, with the main commercial centre and government services headquarters located in the district known as Bairiki.

The country's economy is based on revenue from fishing licenses, fish and lobster farming, manufacture of handicrafts and boat building, and remittance from I-Kiribati working overseas. The currency is the Australian dollar.

Kiribati is one of the 12 member countries of the University of the South Pacific (USP), and therefore it has access to the facilities of the university, including the USP Centre on Tarawa and, through it, to the USPNet satellite system.

National policies, strategies and programmes

There is limited policy and regulatory activity in Kiribati.[1] Indeed, there is currently no written policy on information and communication technology (ICT) for the education department in regard to providing computers for primary and secondary schools, although there is agreement with the Regional Forum Country Members policy on ICT. However some initiatives do exist in which the Ministry of Education supports some ICT activity in co-operation with the government-owned company, Telecom Kiribati Ltd (TKL).

Current level of ICT access and use

Currently, the only Internet service provider (ISP) is Telecommunication Services Kiribati Limited (TSKL), which is 100 per cent government owned and a monopoly. TSKL has 2,000 main lines operating at full switch capacity.

As yet, there is no Internet culture and very limited Internet access, with only 40 dial-up ports and about 400 Internet subscribers.[2] Christmas Island has one dial-up modem operating through Telstra.

TKL has provided eight computers in the National Library, five of which are connected to the Internet. Users are charged US$ 2.80 per hour for general computer use and US$ 5.60 per hour for Internet access. The service is more or less a business venture. TKL is planning to set up more computers in other locations as the room restriction prevents expansion of the current lab in the National Library.[3]

There is one Internet cafe in the whole of Kiribati, and it is located at the main office of TSKL in Bairiki, Tarawa.

Elementary Education

There are 90 primary schools throughout the country with a current enrolment of about 14,000. None of them have computers yet.

Secondary Education

While several high schools have computer labs, the only well-supplied school computer labs are at the government-owned high school and the Moroni High School which are located in South Tarawa. The government school is connected to the Internet, but the connection is only available at certain times in order to reduce the high cost of the connection charge. An increasing number of students at these schools later enrol in the USP Centre of continuing education computer course, or they enrol at the Tarawa Technical Institute (TTI).

Some other high schools have computer labs as well, but without Internet connectivity. They get computers from secondhand dealers overseas (Australia and New Zealand) on the initiative of particular school administrators.

Computer awareness programmes in some schools follow the external examination syllabus based in Fiji, while others have made up their own programmes.

Post-secondary Education

USPNet. A satellite system for distance education is provided through the USP for its students. The USP Centre in Kiribati (on Tarawa) provides degree, diploma and vocational certificates through both distance education and onsite courses to all eligible students throughout the country, including those from Christmas Island. Distance education students on Tarawa have access to interactive instruction through USPNet, the communications network of the university. This enables students to complete a large proportion of the courses for the university programmes without having to attend classes on other campuses.

In addition, the Centre has a continuing education programme that is open to the general public. The programme aims to increase the number of computer literate people in Kiribati. The programme is in three stages and the course content includes hardware familiarity, compulsory keyboard skills, word processing, spreadsheet, database, file management and Internet. Students graduating from the three-stage programme should be able to type at 60 words per minute with 98 per cent accuracy. Graduates are issued a Certificate in Basic Computing Skills. The course is heavily subscribed and it has an average enrolment of at least 50 students for each stage – a significant increase since its inception in 1998. The main constraints at the moment are insufficient number of computers and a lack of computer space.

Tarawa Technical Institute. The Tarawa Technical Institute is the only other institution that teaches a certificate programme on computers. Their computer labs have about 20 computers each and there is Internet connectivity in one lab for four computers with the charges being picked up by AusAid. However, the connection is usually turned off to reduce costs – not an uncommon situation across all government offices.

Broadcast Technologies

Radio. Communications to the 17 outer islands is through high frequency radio, grouped in six substations with 20–80 mile hops. Table 1 outlines an initiative to use radio for teaching at the primary level.[4]

In addition to the primary schools programme, there are non-formal education programmes broadcast over radio by the Health and Agriculture departments.

The Agriculture Department's weekly programme broadcast covers small farming techniques and proper animal husbandry. It has a good audience and the evidence of the success of the broadcast is seen in the small farming projects in Tarawa. There are reports that people in the outer islands are also engaged in small farming for cash crops.

The Public Health Department broadcasts information on nutrition, prevention of communicable diseases, particularly AIDS. It backs up its information with posters on AIDS that are set up in strategic locations around Tarawa.

Television. There is no local television service yet, although there is speculation that the Publishing and Broadcasting Corporation (another government company) will initiate a service. The St. Louise High School is the only high school in South Tarawa that has a satellite dish and can connect to TV channels, mainly from Australia.

Major initiatives

An initiative[5] has been launched by TSKL in which all eight secondary schools, the tertiary training schools and the one nursing school with the Ministry of Health are to be provided with two computers each that connect to the Internet. The computers and all the connections are to be provided by TSKL and the schools are then to be charged for an Internet connection at US$ 2.80 per hour. The other 32 junior

Table 1: Radio Broadcast to Primary Schools

Subjects covered in broadcasts	English, Math, Environmental Science, Vernacular Language
Time of broadcasts	Four days a week (Mondays– Thursdays) for two hours from 9:30 to 11:30 a.m.
Target group	Classes 1-6
Preparation site	Broadcast studio in the CDRC compound (funded by the British government)
Service provider	Publishing and Broadcasting Corporation (BPA)
Equipment	Radios given free to all primary schools but funded by UNESCO
Programme budget	• 2003: US$ 15,400 to cover expenses for radio air time and wages of the two officers • 2004: US$ 42,000 to cover additional air time and cost
Objectives	• Provide an additional teaching mode – listening and understanding. • Help reduce the pressure of teaching multiclass school situations that are common in the outer islands. • Provide an additional source of information for teachers – very few primary schools have libraries
Programme use by primary schools	Recent surveys conducted by the Education Department and presenters of the programme revealed that many schools in the outer islands are making use of it, but very few schools in Tarawa are doing so
Constraints	• Not enough air time to include other subjects • Budget allocation is just enough to barely cover expenses for what is being done • The programme still cannot reach the remote parts of Kiribati • Different time zones mean that the eastern Kiribati group is ahead of Tarawa and the rest of Kiribati, which means that synchronous broadcasting is impossible • The plan to have a radio link via TSKL satellite is currently too expensive
Proposal and plans for the future	• Constraints can be eliminated if the department has its own broadcasting unit in Tarawa and Christmas Island. The initial establishment cost may be high but the benefits would outweigh it. • There are plans to use the Internet, but the major constraint is the high charge of the Internet fees.

secondary schools (Forms 1–3), which are funded and run by the government and located in the outer islands, are not included in the project due to their isolation.

Another initiative is the World Health Organization's training of medical personnel. This involves the establishment of a 10-PC computer lab that will have Internet access, and will be used for training of health workers. It is being managed by the USP Centre and there will be technical support provided by USP until the end of 2004. Two workshops are to be provided by USP for health trainers to gain ICT skills. The facility will also be used for distance education studies of Kiribati health workers.

Examples of training

Training is weak in Kiribati. Most of the people skilled in ICT are graduates from USP and other overseas institutions and there are not very many of them. The USP Centre and Tarawa Technical Institute (TTI) offer computer courses that are mainly geared for software applications such as word processing, spreadsheet, database and use of the Internet. The number graduating from these courses is increasing so that the bulk of computer operators in most ministries, and in the private sector, are graduates of these two institutions. The government is showing support for the computer courses by sponsoring civil servants to take TTI computer courses, and refunding fees paid by teachers and other civil servants who successfully complete the USP computer continuing education programme.[6]

Constraints on the use of ICT

The main constraints are a lack of infrastructure (e.g., telephony connections and a lack of computers) and the cost of Internet access. Just getting a telephone in a private home takes about three years.

Analysis

Radio appears to be utilised well for primary education although there is room for extending the programmes to other subject areas. The constraint is likely to be the cost. A likely area for assistance would be to support an independent and dedicated radio station for the Education Department to expand its radio broadcast programmes.

There is a serious deficiency based on the lack of appropriate infrastructure and hardware. A follow-on effect is the lack of access to ICT, and with a major constraint being the charge of Internet access, the increase in telephone connectivity and increasing ownership of PCs in homes will not have much effect unless this is addressed. The monopoly of TSKL does not help the problem. The following are areas that could be considered for further assistance to Kiribati:

- Provide more PC sites and more PCs in schools including primary level.
- Continue the incentive sponsorship programme to encourage educators and students to enrol in computer courses. A good system would be to refund fees to those who successfully complete the course of study. There is a lot of interest in computers but fees are a constraining factor to the majority – particularly to students whose parents do not have regular source of income.
- Formulate regulations and support initiatives that would compel and help the government to give priority to ICT use.

NOTES

1 See the Asia Development Bank's report on information and communication technologies in the Pacific (Vancouver: COL, 2002).
2 See note 1 above.
3 Information provided by Permanent Secretary of Education (Takei Taoaba), Kiribati National Librarian (Kunei Etekiera) and Rakei Tamati (collector of charges for TKL computer use from general public).
4 Information provided by Rubennang Taukoriri, Acting Senior Education Officer.
5 Information provided by Pinto Katia, Manager of Internet Services for TSKL.
6 See note 5 above.

Marshall Islands

ICT USE IN EDUCATION

Ms Ruby Vaa[1], Ph.D

INTRODUCTION

The Republic of the Marshall Islands (RMI) lies north of the equator, southwest of Hawaii. It consists of a double chain of coral atolls and over 800 reefs spread over 2 million square kilometres of sea. The atolls have a total land area of 181 square kilometres. Of the 34 atolls, 25 are inhabited with a total population of 56,000 (2002 figures) who are primarily Marshallese. The official languages are Marshallese and English. The main atoll is Majuro, one of the two main population centres, and the main commercial centre, with seaports, airports and government services headquarters. The other main atoll with a population concentration is Ebeye.

Politically, RMI is associated with the USA through a compact of free association. There is a legislative assembly of 33 members, elected every four years. The elected president is the head of state and leads a cabinet of appointed state ministers.

The country produces fish, trochus shell, oysters, black pearl and clam, as well as some copra. Marshall Islands is one of the 12 member countries of the University of the South Pacific (USP) and therefore has access to the facilities of that institution including the USP Centre in RMI and through it, the USPNet satellite system.

National policies, strategies and programmes

The RMI has recently endorsed a national strategic plan, Vision 2018, to guide the development of the country for the next 16 years. The plan strongly emphasises the need to develop its human resource potential through improved education and specific human resource development initiatives. The report proposes to "establish a knowledge-based economy by equipping Marshallese citizens with internationally competitive skills, qualities and positive attitudes to work and society." The resulting resource development plan is broad and recognises the wide range of development required but does not specifically detail an approach to the co-ordination of information and communication technology (ICT) and ICT programmes.

A report of the National Training Council, Labor Market Report, produced in October 2002, discusses ICT issues. It indicates that ICT skills:

> ...are increasingly important in all RMI government and non-government enterprises, as they are to governments and enterprises worldwide. It is imperative that RMI increases the ICT skills of its workforce in order to communicate effectively both within RMI and to the world outside. It is important that RMI has a pool of multi-skilled young ICT experts to manage its ICT systems. There is currently a worldwide shortage of ICT employees and suitably qualified RMI citizens will be able to compete internationally for work in this field.
>
> There are eight major job categories in the ICT sector. These categories comprise database development and administration, digital media, network design and administration, programming/software engineering, systems analysis and integration, technical support, technical writing, web development and design.
>
> Through interview, RMI managers indicated that they needed people with skills in:
>
> - database development;
> - network design;
> - systems analysis;
> - technical support;
> - web development.

The report indicated a need to produce about 50 new ICT graduates per annum for the foreseeable future. This target has not yet been met nor has the labor market expanded sufficiently to create the full demand. It is expected, however, that the demand will eventually develop.

Current level of ICT access and use

The RMI has 78 public schools and 25 private schools spread over 25 atolls. Only five of the atolls have regular power, although some have access to solar power for radio and lighting. As a result only a small number of sites have the infrastructure to allow the use of ICT.

Elementary Education

The major population centres of Majuro and Ebeye have some computers available. Most computers in RMI schools are in Majuro. The eight public elementary schools have computer laboratories that are networked (tenuously) to printers within the laboratory. The majority of the computers have been supplied under the After School Care programme and are intended for student use to build language, math and computing skills after school hours, but they are available for school use during the day.

A plan to link these schools to the Ministry of Education office in a wide area network using wireless links is under investigation and a donor for the service is being sought.

Secondary Education

The high school in Majuro has a computer laboratory, which is used to teach general computing skills. Very little use is made of it as a medium for teaching the broader curriculum.

The high schools in Jaluit and Wotje both have computer laboratories. Satellite links to these two atolls allow Internet connections for these high schools.

Post-secondary Education

College of Marshall Islands. The College of the Marshall Islands (CMI) has the largest education-related computer

facility. It serves three purposes at the moment and a fourth is in development.

The first and major purpose is to provide computing services to college staff. Regular turnover of key staff has meant that the network processes have been extremely limited and used mainly for print services. Using Peacesat for linking to the Internet has been irregular and thus the use of services external to the RMI has been very low.

The second purpose is to provide access to students both for studying and writing. For business studies students, it becomes the vehicle for development of ICT skills. The level of ICT skills being targeted is at the lower end of the employment market. High-level networking and software development are not regularly taught, although an adjunct programme in basic networking has begun in conjunction with the Bank of the Marshall Islands.

Students are also able to use the college intranet where they can access notes posted by faculty and submit assignments. Essentially it is application of distance education processes on the college intranet that allows staff to observe project development and provide more intervention opportunities before projects are completed.

A third purpose is hosting a satellite service linked to the Peacesat, which provides a teleconferencing connection to any outside link. Connection is made mainly to Hawaii, Guam and other Micronesian islands. The satellite station is linked by landline to a second satellite managed for the Emergency Services Center. Together these two satellites have the potential to provide teleconferencing, Internet access and 10 voice links channels. The Emergency Services satellite has emergency service as its first priority, so the network is secondary.

A network of landlines connects the college, the Emergency Center, the Ministry of Health, the Majuro Hospital and the Pacific Regional Education Laboratory (PREL) Office in the Ministry of Education. The teleconferencing service is used regularly by PREL for staff training. It is being further developed at the hospital for use in telemedicine to enable remote medical consultations.

A consortium of local agencies (college, hospital, Ministries of Education and Health) has been established in partnership with the Telecommunications and Information Policy Group (TIPG) at the University of Hawaii to manage the Peacesat connections to ensure there is an appropriate management process for the RMI Peacesat arrangements.

A gateway to the Internet has been provided for education purposes. While it is only a 64K link it provides the college and health services with an alternative link to the current Internet service being provided by the National Telecommunications Authority (NTA), the national telephone carrier. These current services are provided through a rather narrow bandwidth and at a high price of US$ 3.60 per hour or US$ 2,000 per month for a 128K 24/7 link – although the NTA has waived fees for official educational Internet use.

A fourth purpose of ICT functions at the college is to provide a base for students to engage in distance education for the completion of four-year degrees and to provide an alternative source for any specialist subject for two-year degrees not covered by the college. An Internet cafe for distance education students is in development. Internet connections for this service are still under review. This arrangement will reduce training costs since students can remain on island and, in many cases, in their current place of employment.

The USPNet. A complimentary satellite service for distance education is provided through USP for its students. The USP Center in the Marshall Islands provides degrees, diplomas and vocational certificates through both distance education and on-site courses to all eligible students throughout the Marshall Islands. Distance education students have access in Majuro to lecturers and instructors through USPNet, the communications network of the university. This enables students to complete a large proportion of the coursework for university programmes without having to attend classes on other campuses.

Institute of Vocational Education. An Institute of Vocational Education is being developed by the RMI, supported by an Asian Development Bank loan, to cater for early school leavers. It will provide programmes to enhance general development skills and to provide initial vocational training. A computer laboratory has been provided as part of the plan, with a major part of the training provided through interactive use of computers, allowing an individualised training programme for each student. A search for appropriate interactive programmes is currently underway.

In-house Education in the Ministry of Education

The PREL office in the Ministry of Education is linked to the office in Hawaii through the Peacesat satellite network. This facility is used for teleconferences that involve RMI-based personnel in programmes conducted by PREL.

Ministry of Education

The RMI Ministry of Education has received computers from various donor grants but does not yet have an operational network linked to a server. The delay is due to a lack of personnel with technical knowledge. Currently, the Bank of the Marshall Islands is providing support service to complete the installation of the Ministry network and will then provide ongoing support to in-house staff once recruited.

Broadcast Technologies.

Radio and television have been operating for a while in both Marshallese and English. Majuro, that has about half the population, has access to television, one government AM radio station and three FM stations. Majuro also has a large number of video shops. Some of the atolls close to Majuro can also access the AM radio station. The main focus of government radio is music, news and reporting the proceedings of the Nitijela (the local parliament). The radio is not currently used for school or educational broadcasting. Television relays of a number of satellite stations (CNN, BBC, movies, etc.). There are slots for local events, but the media is not used for educational purposes.

Major initiatives

Major initiatives using ICTs have been previously described. Briefly, they are:

- Intranet for tuition use at the college;
- Satellite links through the USPNet;
- Internet cafe for off-island distance education;
- Wide area network for teleconferencing in health and education;
- Planned wide area network to link schools in Majuro, to provide links to the Internet and caching of popular websites;
- Vocational education using computer-assisted training to develop basic language and math skills as well as provide information about vocational options.

Examples of training

So far training has been limited to the CMI and USP. While large numbers have been enrolled in ICT training degrees, very few have graduated. The most qualified graduates are snapped up by the major ICT employer, the Bank of the Marshall Islands, which is building the best pool of ICT expertise in the country.

The Ministry of Education paid for a small number of intern staff (students who were assisting in the installation of network arrangements in the ministry office and schools) to attend network-training programmes in Hawaii, but due to an inability to promptly offer employment, the interns chose to work with the bank instead. This has, however, had a serendipitous benefit because the ministry has established a computer support arrangement with the bank. The PREL office in Hawaii provides a regular series of ICT awareness and skills development programmes on island.

In summary, the long-term need for trained staff will not be met from current arrangements, particularly those relating to networking, systems administration and software development.

Constraints on the use of ICT

A major constraint is the lack of a focus for ICT development in the country. Each arm of government is developing its own vision with little or no co-ordination. The Ministry of Finance, because it needed to allow online access in major departments of government, has set up a wireless wide area network with US technical support.

General use of ICT outside of the four major centres in the country will be limited until sustainable power sources and innovative uses of technology can be explored. Designs for long-distance radio-supported low-band e-mail are under discussion.

ICT access for elementary students is limited to Majuro and Ebeye. This is exacerbating the disparate nature of educational offerings among children in the RMI. Technical support is very limited even on the sites with large numbers of computers.

Analysis

There is a need to provide a more co-ordinated and focused training initiative in order for the crucial aspects of ICT technical support to be available. Furthermore, follow-on employment opportunities at the Ministry of Education need to be created in order to maintain trained personnel so the expertise is more readily available for education initiatives.

Broadcast technologies appear to be underutilised for education and much potential exists with this medium, particularly given that the atolls are spread over such a wide expanse of water. For instance, the use of radio for delivery of educational programmes as in other Pacific islands could be considered, particularly for schools at the elementary level, while television could be utilised for delivery of distance education programmes. The constraint here is likely to be the cost.

NOTES

1 This paper does not represent an authorised government view. The author, Leatuaolevao Ruby Vaa, co-ordinator of the Pacific reports, provided context and analysis (*vaa_r@samoa.usp.ac.fj*). Other views in this report are of Martin Caust (*mkcaust@fastmail.fm*).

Federated States of

Micronesia

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

The responsibility for education in the Federated States of Micronesia (FSM) is shared between the national government and the individual states of Chuuk, Kosrae, Pohnpei and Yap. The FSM has a strategic plan to provide overall guidance for improving education in the country. However, the states have the primary responsibility for instruction with the national government providing support and assistance. As a result, the individual states also have their own plans for the improvement of education and for the use of information and communication technologies (ICTs).

Free public education is provided for children in the FSM through the completion of grade 8 or age 15. High school attendance is based on passing a high school entrance examination.

Funding for education in the FSM is primarily provided through Compact funds provided by the USA with a significant amount also provided under US federal education programmes. The US regards the FSM National Department of Education as a state education agency (SEA) and each of the state departments of education as local education agencies (LEAs). The majority of funding under these programmes is delivered directly to the individual states. The country has experienced a reduction in the amount of funding provided during the past several years, which has had a negative impact on their ability to meet the educational needs of students.

The FSM supports one institution of higher education, the College of Micronesia – FSM (COM-FSM) with a national campus in Pohnpei and state campuses in each of the states. COM-FSM offers associate's degrees and also has a third-year programme in education. The University of Guam works with COM-FSM to provide the additional courses needed for a bachelor's degree in education on its campus in Guam and via distance learning. In addition, San Diego State University (SDSU) and other universities provide distance learning courses in the FSM.

Well-trained teachers are essential for the development of an effective education system in the FSM, and the national government has recognised the need to improve teacher training. Currently, approximately 85 per cent of the teaching staff have less than a bachelor's degree and a substantial percentage have only a high school diploma. Significant efforts have been made to increase professional development opportunities for teachers through distance learning technologies. PRELStar: A Pacific Islands Distance Learning Program and the Pacific Regional Technology in Education Consortium (PR*TEC), funded by the US Department of Education and managed by Pacific Resources for Education and Learning (PREL), have provided both distance learning and face-to-face inservice and pre-service training for teachers as well as training of faculty at COM-FSM in the development and delivery of distance learning courses. However, substantial additional funding will be required to meet the needs of the country.[1]

The FSM has recognised the importance of data-driven decision-making in education. One of the goals in its strategic plan is to develop "appropriate assessment and evaluation systems for all levels of education and will use those systems as the basis for decision-making, resource allocation, and planning and development."[2] Through the US-funded Freely-Associated States Educational Grants Program (FASEGP), staff from the states and the national government have developed a database of information on education in the individual states as part of this effort.

The national and state governments also recognise the need to improve telecommunications access throughout the country and to develop effective information management and communication systems. However, the costs of upgrading this access and extending it to schools throughout the four states will require substantial outside funding both for the initial infrastructure investment and for ongoing recurring costs. Until this funding is identified, the governments will not be able to significantly improve telecommunications access to schools.

The strategic plan specifically addresses the need to develop a technology literate population. The main goal in this area is "to develop a technology literate population to rapidly respond to changing conditions in the world economy" through the following five objectives:

- Provide quality mathematics and science programmes to form the basis for understanding and using current and future technologies;
- Develop student computer literacy for understanding and use of information technologies;
- Develop operational plans for effective use of the Internet and other information technologies for improvement of instructional support staff training and programmes;
- Provide for repair and maintenance and upgrading of technological resources;
- Allocate financial and technical resources for information and communication technologies[3].

Current level of ICT access and use

A total of 195 schools located on islands and atolls across an ocean expanse greater than the area of the continental United States serves approximately 34,179 children in the FSM. Of these schools, 74 have fewer than 100 students and 43 have fewer than 50 students. Most of these small schools are located in remote outer islands.

Telecommunications and power are not available on all islands or to all schools (see Table 1).

The FSM Telecommunications Corporation (FSM Telecom) became an Internet service provider (ISP) in December 1996. Phone and Internet services are available to schools on the major islands of Chuuk, Kosrae, Pohnpei and Yap and on the outer island of Ulithi in Yap State. However, the cost of bandwidth is high and not all schools are connected.

Table 1: Schools and accessibility

State	Schools with power (%)	Accessible from DOE by auto (%)	Accessible from DOE by boat (%)	Accessible from DOE by ocean ship (%)	Accessible from DOE by small plane (%)
Kosrae	87.50	87.50	12.50	--	--
Pohnpei	75.00	82.50	5.00	12.50	--
Chuuk	17.30	18.40	51.00	31.60	--
Yap	40.00	40.00	--	60.00	31.00
All schools in FSM (%)	**37.60**	**39.80**	**29.30**	**31.50**	**6.10**

FSM Telecom operates a reliable fibre/copper ring system and NORTEL digital switch on the four major islands. Internet service is also provided on these islands and the company has steadily increased the bandwidth available. Long distance phone calls to and from states in the FSM currently cost US$ 1–2 per minute; and direct Internet access is available at a cost of US$ 19.95 per month for 10 hours of service, with additional hours charged at US$ 1.95 per hour.

Flat-rate symmetric and asymmetric leased circuits are also available on the main islands. The cost of these services ranges from US$ 1,150 per month for 64 kbps of dedicated bandwidth to US$ 18,350 per month for 1536 kbps. Unfortunately, the high cost of on- and off-island services limits the abilities of the departments of education to provide Internet access to students in schools. Where such access is provided, the schools must restrict use due to limited bandwidth.

COM-FSM has a 512K connection to the Internet through FSM Telecom that provides access for the national campus and all four state campuses. It manages the bandwidth among the campuses through CISCO routers. PREL, through its PRELStar programme, and the University of Hawaii, through its Peacesat project, have collaborated to provide a 128 kpbs videoconference network serving COM-FSM and each of the state departments of education. This network connects with the Peacesat bridge in Honolulu, Hawaii, and is available for use by the education, health and government sectors.

Outer islands with schools and health dispensaries generally rely on high frequency/single sideband (HF/SSB) radios. In Chuuk, for instance, 75 per cent of students attend schools with only this type of access. Future plans to serve the outer islands include the installation of a very small aperture terminal (VSAT) network attached to a wireless local loop (WLL) directly connected to FSM Telecom's digital switch.

At the school level, ICT access varies widely. Computer labs are operating at the main schools in Weno, Chuuk, including Iras and Sabok Elementary and Weno, Chuuk, and Xavier High Schools. In Kosrae and Pohnpei, computer labs are also operating in most schools. On the main island of Yap, all schools are connected though the Yap State Education Enterprising Department's (SEED) wide area network (WAN). This network uses microwave technology to connect all schools. Yap SEED also deploys wireless connectivity at some schools and maintains a computer lab at its offices for use by students and teachers. Computer labs are available at most schools on Yap and on most of Yap's outer islands including Ulithi, Wolei and Satawal.

Distance education is increasingly being used by organisations in the education and health sectors. COM-FSM, departments of education, PREL, SDSU, the University of Guam, the University of Hawaii and other educational businesses are using distance education to provide teacher training in the FSM. The US Army uses distance technologies to provide medical diagnosis, evaluation and training, and the Center for Disease Control and the Health Resources Services Administration use the infrastructure to deliver programme updates. The technologies used range from online courses designed for low bandwidth access to courses using synchronous videoconferencing, videos, traditional print and various hybrid forms of media.

Major initiatives

Despite the high cost of telecommunications access, the low level of teacher training, the lack of funding and the different approaches developed by the four states towards the integration of technology into the curriculum, the past five years has seen an increase in the local telecommunications infrastructure and in the use of technology in the schools.

For example, Yap has made significant progress in providing teacher training in technology integration. Through the efforts of the former Director of Education and his Director of Technology, computer laboratories were installed in most schools, a WAN was developed connecting schools on the main island, a state-of-the-art "smart" classroom was

installed at Yap SEED headquarters for use in teacher training and Internet access was extended to Ulithi. Local SEED staff leveraged the resources provided by PREL, Peacesat, and various private and federal grants to engage both students and teachers in using technology. Learning materials, including early childhood books in Yapese, were developed, as well as art education and web design courses for high school students. Despite this progress, however, the lack of a strategic plan integrating technology into the curriculum has prevented Yap SEED from realising the full potential of ICTs in education. Curriculum developers and technology staff often worked independently of each other. Some of the curriculum developers lacked understanding of educational technology or even basic technology applications and some of the technology staff lacked understanding of curriculum development.

COM-FSM has also made significant progress in integrating technology into its curriculum and in extending educational opportunities by forming strategic alliances with other colleges and universities to improve and extend course offerings through distance learning. It is currently working with SDSU to provide courses for students and with PREL and other institutions of higher education in the region to develop a series of six basic 300- and 400-level courses for teachers with an associate's degree who are working toward a bachelor's degree. The college has also been providing professional development to teachers in local schools under a grant from the United States Department of Education.

From 2001 to 2003, PREL, in collaboration with Western Illinois University, offered a master's degree programme in instructional technology and telecommunications. The programme was designed to train a cadre of educational leaders from the region in instructional technology. One student from each of the four state departments of education and the manager of COM-FSM's technology department participated. Three of these five participants completed the coursework and earned their master's degrees (one was forced to drop out due to a serious health problem and one was unable to handle the heavy course load). These leaders are now working within their local departments of education in the integration of educational technology into the curriculum.

For the past two years, the University of Guam has received funding from the Sasakawa Pacific Island Nations Fund (SPINF) to assist the FSM states in developing distance learning plans. Each state has developed a distance learning plan to address the needs of education, health and government. (These plans are available at *www.demicro.org*.) The University of Guam has co-ordinated its activities in this project with those of PREL and the University of Hawaii to provide co-ordinated assistance and training in the development of these plans as well as regularly scheduled teacher training workshops throughout the FSM.

A major initiative is currently being tested to improve telecommunications to remote islands through the use of satellite broadcast. This system has been designed to provide low-cost telecommunication links to islands with only HF/SSB radio communications. Using a combination of solar-powered receivers, computers and printers, the link provides low speed (9,600 bps) data broadcast throughout the FSM. If the initial tests are successful, this network will allow FSM departments of education to deliver printed material to some of their most remote schools.

Examples of training

Individual departments of education, COM-FSM, PREL, the University of Hawaii, the University of Guam and other organisations have provided training to teachers in the FSM. The individual departments of education have provided a number of workshops, often in collaboration with an institution of higher education or one of the regional service providers. COM-FSM has developed basic ICT training for inclusion in its degree programmes.

PREL is working closely with each of the departments of education in training trainers and teachers in the integration of technology into the classroom. This training focuses on integrating application skills into the curriculum and linking the National Educational Technology Standards (NETS), developed by the International Society for Technology in Education (ISTE), to local curriculum standards. These standards use an integrated, problem-based approach to developing unit and lesson plans incorporating technology. The step-by-step instructions and examples provided in the ISTE materials are particularly useful in working with teachers in the FSM who have little or no experience in developing lesson plans.

Ongoing ICT training is being provided through a 21st Century Community Technology Center grant to department of education staff in Pohnpei and through PREL and the University of Hawaii in all four states. A CD and other support materials are being developed and delivered to operators of the videoconference network in an attempt to improve the availability of the network. Training is provided face-to-face, through videoconferencing and online.

Constraints on the use of ICT

The lack of affordable telecommunications access is a major constraint on the use of ICTs in the FSM. Each of the distance learning plans for the individual states highlights this as a barrier to the integration of ICTs into the curriculum. The costs of providing telecommunications access in the FSM are among the highest in the world because of the country's geographical remoteness and small population.

The market is just not large enough to bear the initial and recurring costs of providing the service.

Second, the departments of education within the FSM are facing severe financial pressures. The reduction in funding under the Compact of Free Association with the US has resulted in a lack of funding for basic hardware and software as well as for required improvements in classrooms or computer labs. Some departments are unable to provide power on a continuous basis to schools. The poor physical condition of many schools results in damage to computers. In addition, the high humidity and salt air of these islands significantly reduces the life of computers unless they are kept in a controlled, air-conditioned environment.

Third, the level of teacher education in the FSM is low. As noted earlier, 85 per cent do not have a bachelor's degree and more than 30 per cent have only a high school diploma. With the current pay scale and physical conditions of the schools, it will be difficult to attract qualified teachers or to require current teachers to continue their formal education.

Finally, all of the training materials available are in English and designed for use with teachers who have a higher level of education, access to a wide variety of resources and high proficiency in English. As a result, it is often difficult for teachers in the FSM to relate to these materials or to understand the language used.

Analysis

The past five years has seen a marked increase in the use of ICTs in the FSM. However, significant further improvement depends on the expansion of the ICT infrastructure, a reduction in bandwidth costs, additional funding for education and improved education and training of teachers.

The FSM cannot afford major investments in ICT infrastructure to remote regions or sustain the ongoing costs of providing that service. Unless bandwidth costs are substantially reduced, students will continue to have very limited, if any, access to ICT. The technology to maximise the efficient use of bandwidth is already being deployed by COM-FSM and Yap SEED, but there still remains a need to increase the bandwidth available for their users.

A small amount of assistance to schools for telecommunications access would greatly increase the use of ICT in the FSM. In the United States, the e-rate programme provides a subsidy for telecommunications access to schools and has greatly increased the use of ICT by making access more affordable. A similar programme, funded by outside sources, would facilitate the use of ICT in the FSM.

The increased use of ICTs will also require additional funding for education for physical improvements to schools, hardware and software purchases, and teacher training. The physical condition of computer labs must be upgraded to protect and extend the life of the equipment. Teacher training in the integration of technology into the curriculum should be ongoing using both face-to-face and distance learning technologies. A training plan should be developed for each of the departments of education to provide for this ongoing training of teachers. However, the plan can only succeed with dedicated funding.

NOTES

1 Catalino Cantero, "Strategic Plan for Improvement of Education in the Federated States of Micronesia" (Pohnpei: FSM National Division of Education, 1997), 8.
2 See note 1 above, p. 37.
3 See note 1 above, p. 71.

Nauru

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Nauru is located south of the equator, southwest of Honolulu, Hawaii. It is a single raised coral island with a land area of 21 square kilometres. The population (2002) is 11,845 with a growth rate of 2.05 per cent.

The economy was based on phosphate mining but that has now run out leaving the nation dependent on investments and aid. There is no income tax or direct tax.

Education is free and compulsory for ages six to 16 years. There are four primary schools: Aiwo (junior primary attached to Nauru College), Yaren Primary, Kayser (together with primary and secondary) and Nauru College (senior primary). There are also four infant schools: Menen Infant, Nibok Infant, Boe Infant, Anen Infant (part of the Kayser College complex). Kayser College (Catholic mission establishment) includes infant, primary and secondary schools in one location. It is helped a little by the government but mostly it is a private educational institution. There are only two secondary schools: Kayser College and Nauru Secondary.

National policies, strategies and programmes

In 2002, the Telecommunication Act came into force and resulted in the establishment of the RONtel Corporation. RONTel stands for Republic of Nauru Telecommunication Corporation. The Act establishing RONTel sets out, among other things, the telecommunication services to be provided and the rates, charges and licensing system. At present, the corporation is working on strategies to implement its mandate.

Current level of ICT access and use

General

- A telephone system comprising twisted pair copper wire telephone lines was installed by a Japanese company in the 1970s. However, most of the lines have rotted away due to soil and water corrosion.
- LAN line Internet connectivity uses the Japanese telephone lines. This is operated by RONTel for the whole island. Because of the status of the telephone lines, only half of the island (Menen, Aiwo, Yaren and Boe districts) are able to use the connection.
- There is a joint venture by Central Pacific Group (Cenpac) and RONtel to operate an Internet cafe that has five PCs for public access.
- There is also a joint venture by Nauru Phosphate Royalty Trust (NPRT) and RONTel to operate an Internet cafe with nine PCs using a dial-up connection.
- Cenpac has 16 modems for local subscribers. It has been in operation since 1998 and one of its roles is to market the domain name ".nr." Cenpac has a newly established website at *www.www.nr* for local online marketing and other notices, announcements and information, in addition to its first website, *www.cenpac.net.nr.* Cenpac is holding discussions with Telstra Australia and Pacific IP (New Caledonia) on the possibility for better Internet access.
- Plans for a Telecom-GSM Mobile service are on hold.

Education

- **Nauru College** is currently equipped with 26 working personal computers to cater to the educational needs of both school children and teachers. Educational software in all key subjects is being used to aid the major areas of the curriculum. Programmes are also utilised to produce creative projects beside the usual papers and research required by regular subjects. The inkjet printer, CD-writer and scanner are used to create posters, postcards, business cards and newsletters that are designed and printed by the pupils in the computer lab, and lesson plans and teaching aids worked on by the teachers. For the past two years even the annual school magazine has been produced through desktop publishing in the lab. At present only five PCs are networked for Internet use. Members of the staff pay a fee for this service every month so they can have the liberty of using e-mail, keeping track of world news and doing educational research.
- **Kayser College** has only had computers for one year. There are 16 PCs networked with a printer, but none has an Internet connection. Basically they are used to familiarise the students with computers. There is only one teacher responsible for all computer training for school children and teachers. This teacher attended PC training with a Japan International Cooperation Agency (JICA) programme.
- **Aiwo Primary, Yaren Primary, Location School and Nauru Secondary** all have computer labs with 12 PCs for student use.
- **Nauru Secondary** has a lab with 20 PCs also for student use.

As well as the above, four district infant schools all received one PC each for staff use. Other schools have received PCs as a donation from Taiwan.

Other ICT

There is an FM radio station, 888 FM, which broadcasts only news and music from 7:00 a.m. to 11:30 p.m. seven days a week. Nauru TV broadcasts news, sports and daily educational programmes from ABC Asia Pacific on how to

speak English properly and from China TV on how to speak Chinese. There are no locally produced programmes as yet.

Nauru TV and Radio Nauru are part of the Department of Economic Development of the government.

Major initiatives

USPNet

Nauru belongs to the regional University of the South Pacific (USP) which is owned by 12 member countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. The university has a privately owned satellite system that was upgraded in 2000 and is fully functional for all 12 countries. It operates under strict conditions agreed to with the national telecommunication carriers. The system allows audio, data and video interaction.

For Nauru, USPNet is the most successful initiative to date and is the system that the USP Centre depends on for communication with other parts of the university. The Centre has a six-PC computer lab dedicated to student use. There is also a PC for audiographics in the audio conferencing studio, and another PC in the library for online searches. As part of the regional university, Nauru benefits from this regional network through which university courses are accessed by video broadcast supported by the WebCT Internet programme. Law courses can be studied online and print-based courses are supported via audio and video conferencing. The Centre is able to participate in regular regional staff meetings as well. In a recent development, university centres and campuses have been linked up so that an "internal" telephone system is accessed.

USP Community Outreach Programmes

USP Nauru Centre also accesses the continuing education programmes that are co-ordinated from Suva, such as the preschool teacher certificate, disabilities studies and community nutrition. Students of these continuing education programmes are mostly women. Before 2001, the Centre conducted computer awareness and training programmes, but these were stopped due to the daily power outage problems. These will recommence once a generator is purchased or the power problem is fixed.

It appears that most women and young people of Nauru are beginning to utilise and see the potential of the ICT services provided by USP. Records kept since March reveal that students using the computer lab for e-mail, research or assignment preparation are 51 per cent female and 49 per cent male. It appears, therefore, that there is no gender imbalance.

Examples of training

Very little is done in the way of training. Indeed, there is no ongoing training programme organised by the Education Department to develop computer literacy among teachers. However, some teachers, on their own initiative, have taken steps to improve their computer skills in three ways:

- By enrolling in basic computer courses at the USP Nauru Centre or through correspondence via Education Direct;
- By participating in short-term workshops/seminars on software applications whenever these are offered on the island;
- By self-learning.

It has only been two years since computer studies were first introduced at Nauru Secondary and Nauru College, and one year since lessons started at the Aiwo and Yaren primary schools.

There has not been any external assistance except UNESCO's contribution of some resource materials for the development of the inclusion of computer studies in the school curriculum. Each individual teacher has had to develop his or her own programme based on the resources available and the needs of the students.

The newly established Nauru Telecom Corporation has not undertaken any training as yet, but Cenpac has plans to provide training in the future.

Constraints on the use of ICT

Generally there is a serious financial problem in Nauru and this has halted major plans for training and upgrades. Efforts to improve the situation have led to the Nauru Telecom Corporation being established, but this is only recent and its budget is constrained by many old debts inherited from government. Cenpac's budget and funds are also limited.

The following are the notable constraints:

- The ICT infrastructure is substandard. There is one telecommunications centre on the island and it was only recently privatised.
- Telephone access/usage is very limited and cellular telephones are rare. Thus, a few businesses and individuals have invested in private satellite dishes.

- There is a lack of human resources. ICT professionals and computer technicians can rarely be found.
- There are no computer shops or computer repair centres and all units and parts have to be ordered and shipped from overseas.
- Power outages have affected access and limited training.
- Training programmes are minimal.

Analysis

The financial situation of the country has had a significant impact on ICT development and use and there is a great need for ICT training on Nauru.

There is a serious lack of ICT specialists to provide maintenance and training. For instance, at Kayser College, there is a need for a specialist to teach advanced computer usage, and the PCs donated by Taiwan are apparently under-utilised because there is no qualified tutor and no curriculum for teaching/learning about computers.

Broadcast technologies could be further developed for education and Nauru TV and Radio Nauru would like to get some training to do this.

New Zealand

ICT USE IN EDUCATION

Mr Tom Prebble, Ph.D

INTRODUCTION

In 1989 the governance of the New Zealand education system was radically reformed. From being a relatively centralised system, it became an extremely devolved one. Responsibility for the delivery of education at the institutional level was devolved to locally elected boards of trustees, in the case of schools, or each being responsible for just their local school. The Ministry of Education retreated from most of its former service delivery and quality assurance roles and restricted itself to policy formation and funding, devolving even quality assurance to an independent agency.

National policies, strategies and programmes

However, experiences of the 1990s indicated that there were certain issues requiring stronger "steerage" at the national level. Particularly, it became clear that the government needed to provide some leadership to encourage the developing use of ICT in the nation's school system.

This chapter explores the developing use of ICT by both the schools sector and the technical/vocational and teacher education sector against this context of the competing values of local governance on the one hand, and the national aspiration to participate in the international knowledge economy on the other. The experiences of the two sectors have been quite different, mostly because technical/vocational education and teacher education are both important parts of the tertiary system, which the government also recognised as needing support with respect to the uptake of ICT. For this reason, these two sectors are discussed separately.

ICT in the schools sector

National Policy, Strategy and Programmes

Whatever the reforms in institutional governance may have achieved in terms of institutional autonomy and responsiveness, they posed some serious challenges to the uptake of ICT in the education system, particularly by the schools sector. During the early 1990s, each school met the challenge of ICT in the best way it could and generally without much support or guidance from the ministry. Schools struggled to increase their ownership and use of computers, and there were a few research projects that brought small groups of schools together with their local university or college of education. But in an era when schools were realising that their survival depended on their ability to compete with neighbouring schools for pupils and for community support, there were few inducements for local or regional collaboration in the use of ICT.

There were some noteworthy exceptions. Some of these were in response to the challenge of distance. During the early 1990s, several regional clusters of schools began trials with teleconferencing and computer-based conferencing systems. Networks in the Canterbury region of the South Island and the central and east coast regions of the North Island enabled students to study subjects that could not be staffed from their own schools. In the case of the latter regions, schools with a large proportion of Maori students were able to form supportive learning communities with others wanting to strengthen their knowledge of Maori language and culture. These projects were funded by the Ministry of Education.[1]

In 1998 the Ministry of Education sought to draw on the lessons of these and other early leaders by developing a co-ordinated vision and strategy for the use of ICT in schools. This statement[2] proposed two focus areas: developing infrastructure and improving school capability. In the area of infrastructure, the strategy made commitments to develop an online resource centre to allow schools to access multimedia resources, to encourage businesses to recycle computers for use in schools at low cost and to encourage schools to access the Internet and regions to create local area networks. In the area of improving school capability, the strategy proposed three programmes: one for professional development for principals in the use of ICT, another whereby schools already making successful use of ICT would be contracted to work with clusters of schools and another whereby clusters of schools would be funded to organise their own training and development in ICT.

The ministry published a new strategic statement for the next four years.[3] The document proposed a three-way partnership between government, schools and business: the government's role is to provide strategic leadership, training and support for teachers, as well as a digital infrastructure; the schools are responsible for determining their own development priorities but are encouraged to do so by way of a whole-school approach and in collaboration with their community and neighbouring schools; and business is encouraged to share their experience and expertise and to provide links with the outside world.

Major Initiatives, Training and Development

- The 1998 strategic statement proposed the **ICT Schools Cluster Programme,** in which clusters of schools would support each other to incorporate the new technology both at a classroom and a whole-school level. Clusters are selected through a contestable process. The lead school in each cluster is contracted to take on this role for three years and receives NZ$120,000 a year payable on the completion of key milestones. In 2003 there were 71 clusters operating across New Zealand, and so far about one-third of New Zealand schools are either involved or have been involved in the programme. As the primary vehicle for training and supporting teachers and school administrators in the use of ICT in schools, the programme represents a creative departure from the traditional model of in-service training whereby teachers are taken out of the school for short periods of training and then expected to apply their new skills and knowledge on their return. The ICT Cluster Programme is being actively evaluated.[4]

- ICT professional development and support is also available from the **School Support Services,** a network providing a range of advisory, consultancy and training services. An ICT help desk is also available both by phone and web.[5]

- The Ministry of Education has also sponsored the development of several major online support resources for schools, students and staff. **Te Kete Ipurangi** – The Online Learning Centre[6] – delivers bilingual (Maori and English) access to all material. It is targeted at teachers, and curriculum materials are made available in all seven of the school system's "essential learning areas" as well as in cross-curriculum areas such as literacy, numeracy and ICT.

- The **Principals' LeadSpace**[7] is a portal directed at school principals, senior staff and boards of trustees. It provides ready access to a set of professional development materials, all the key policy documents affecting the management of schools, the online communications tools for reporting to the ministry and other oversight agencies, and a series of communication forums for school managers.

- While government policy commits state agencies to meet the needs of both Maori and *pakeha* (non-Maori), there have been a number of interventions targeting Maori. **Kaupapa Ara Whakawhiti M'tauranga** (KAWM)[8] brings a number of school improvement initiatives together under one umbrella. One is Te Kura Hiko, a videoconferencing network to broaden the range of specialist subjects available to senior students in predominantly Maori schools. Two others are **Project Rorohiko**, an initiative that has supplied nearly 2,000 recycled computers to predominantly Maori schools on the East Coast of the North Island, and the **Wharekura Expert Teacher Initiative**, which provides itinerant expert subject teachers to support both online and school-based teaching.

ICT in technical/vocational and teacher education

New Zealand does not have clearly differentiated sectors for either technical/vocational or teacher education. The Education Act of 1989 recognises polytechnics, colleges of education, universities, *whare wananga* and private training establishments as distinct categories, but none of them has a monopoly on the provision of any type of programme, and institutions are free to offer any qualification for which they meet the accreditation standard. In practice this means that many polytechnics offer postgraduate as well as undergraduate degrees, many universities deliver teacher education programmes and all colleges of education offer programmes targeting groups other than teachers.

Given the overlapping mandates of the various types of tertiary institutions, the government has chosen to address the ICT needs of the tertiary sector at large rather than the specific needs of any sub-sector. On the other hand, there have been some important developments in the use of ICT in technical/vocational and teacher education, which are discussed in their own right below.

National Policy, Strategy and Programmes

Until quite recently, New Zealand did not have a national strategy for the application of ICT in tertiary education, either vocational or non-vocational. In the newly devolved system of educational governance of the 1990s, each publicly funded tertiary institution was forced to compete with its neighbouring institutions for students and funding. Institutions developed their own ICT strategies, and these tended to reflect the scale of their own operations and their need to resource these within their annual budgeting cycle. There was a marked reluctance to embark on capital-intensive ICT projects, or on high-risk collaborations with other institutions or with industry.

The election of the current Labour Government in 1999 heralded an important shift in the governance and management of higher education. The incoming government announced that unfettered competition among education providers was not producing either the most efficient outcomes, or outcomes that were serving the wider public interest. Instead, it signalled an intention to exercise greater "steerage" over higher education. The various reports of the Tertiary Education Advisory Commission[9] indicated how this steerage might be exercised. In summary, a Tertiary Education Commission was to be established to make decisions about the kind and quantity of educational outputs required by the country, and institutions would be contracted and funded accordingly. (ICT is just one area of educational activity where the government indicated a wish to exercise greater steerage.)

In 2001 the Minister of Higher Education set up a group to advise him on the development of e-learning. The final report of the group[10] represents a balance between the need for clearer direction for the sector and the reality of New Zealand's highly competitive tertiary environment. The group was representative of the whole tertiary sector including the colleges of education, the polytechnic sector, industry training organisations (ITOs), and *whare wananga* as well as the universities. The report recommended the following:

- A strong role for the new Tertiary Education Commission in developing a national strategy for ICT in tertiary education;

- Targeted initiatives to use ICT to ensure Maori participation in higher education;
- Development of a national e-learning portal to begin to draw together the various e-learning opportunities available in New Zealand;
- Use of central funding to encourage the development of ICT through collaboration across the tertiary education sector and with industry; and
- Development of national "quality mark" in e-learning to which institutions could subscribe.

Since the publication of the report, the ministry has been drafting an e-learning strategy that draws equally from the reports of the Tertiary Education Advisory Commission (2000/2001) and the E-Learning Advisory Group (2002). It has also launched the Tertiary E-Learning Portal,[11] and at the time of writing it was seeking applications for the first round of grants from the ICT Collaborative Development Fund.

Major Initiatives

There are, as yet, relatively few programmes leading to full degrees that are delivered wholly online. It is noteworthy that several of these are in teacher education. Since the late 1990s, Massey University, Christchurch College of Education and Waikato University have developed online streams for their pre-service undergraduate teacher education degrees. In each case these were designed to meet the needs of mature-aged students living remotely from a college of education and prevented from studying on campus by family and work commitments.

The External Delivery Option (EDO) offered by Massey has placed greatest reliance on online media, setting up virtual groups for most of the study and assignment tasks, and making few if any requirements for students to come on campus. The Mixed Media stream at Waikato combines online communication and tuition with occasional block courses, while the Primary Open Learning Option (POLO) offered by Christchurch College of Education supports their online teaching and learning with regional study groups. In all three cases, the programmes are notable for the quality of the interaction that takes place between the tutorial staff and the students rather than for the sophistication of the online resource material. Students continue to express satisfaction with this mode of professional preparation, as do the schools employing the graduates of these programmes.[12]

Working in partnership with ITOs, many polytechnics and colleges of education are delivering vocational training programmes wholly or partially online. A quick scan of the Ministry of Education's new e-learning portal[11] found online programmes available in subjects as diverse as journalism, construction, graphic arts and design, and accounting,

Very few tertiary institutions have made extensive use of broadcast media. In part this has been because broadcasting has been unable to offer a flexible alternative to the more conventional media used by distance education institutions. But more importantly, New Zealand lacks the scale needed to make broadcasting economically viable. In the early 1990s, a series of trial courses were delivered by television broadcast in collaboration with a number of polytechnics and the New Zealand Broadcasting Corporation. None of these trials survived its first review.

Teleconferencing, both audio and video, has not been a lot more successful. The line costs, the challenge of maintaining regional centres, and the limitations of a real-time medium, have all kept teleconferencing as an auxiliary rather than a primary delivery or support medium for education.

There has been a less integrated approach to training in technical/vocational and teacher education. Individual polytechnics and colleges of education offer their own programmes of staff development and, for most institutions, the application of ICT to teaching and learning has become a significant emphasis of these programmes. Several of the larger institutions offer credit-earning programmes available to students beyond the employment of the host institutions. The E-Learning Advisory Group recommended that institutions collaborate to ensure more cost-effective training for their staff.

Current level of ICT access and use

Reading the professional literature on the development of ICT can sometimes leave the impression that the major determinants of progress are infrastructure and the availability of end-user interfaces. While there may be projects that have been delayed through shortcomings in one or other of these, for the most part infrastructure and access have kept up with the demands of students and the aspirations of institutions.

The Ministry of Education has actively worked to provide all schools with access to the Internet. By the end of 2002, all but a handful of New Zealand schools had Internet access and were on track to achieving broadband connection. There was at least one computer for student use in 81 per cent of classrooms, with secondary schools having an average of one computer for every six students and primary schools one computer for every 10 students.[13].In the general population, 75 per cent of New Zealanders had direct access to an Internet connection, and there were 3.5 million cell phone connections from a population of 4 million.

Institutions in technical/vocational teacher education tend to carry out their own surveys of access levels among staff and students. Almost without exception the access rates of their students from home or work equal or exceed national averages. Institutions delivering their programmes at a distance seldom encounter significant numbers of student who experience difficulty in securing access.

Access to computers has been assisted in recent years by the Laptops for Teachers Scheme, where teachers working with year 7–13 school students are reimbursed for approximately two-thirds of the costs of leasing a laptop. As part of the programme, teachers are expected to undertake professional development aligned to their school's ICT development plan. Laptops have also been provided to principals during 2002 and 2003.

Another initiative, Computer Access New Zealand, has been set up to provide cheap, warranted, recycled computers to schools. And yet another project has been set up to provide recycled computers, training, support and Internet access to students in low decile schools for the use of the students, their families and their community.[14] At the tertiary level, most tutors will have access to an individual work station and issues of access tend to focus on bandwidth or the capacity of their computers.

Maori are a group that has traditionally faced problems accessing high-quality education in their areas of concentration. Several *iwi* (tribal groups) and *runanga* (Maori tribal authorities) are using ICT both to enrich the educational offerings in their rural *rohe* (tribal region), but also to maintain links with their *iwi diaspora*, generally in New Zealand's northern cities. One example is a series of initiatives by Te Whanau a Apanui, an *iwi* whose *rohe* extends along a stretch of remote coast on the East Cape of the North Island.[15] Sixty-three per cent of its members are under thirty and 80 per cent lie outside the tribal *rohe*. The *iwi* is using e-learning programmes as a means of up-skilling its members and allowing them pathways into the ICT industry. Links have been forged with Cisco Systems, and academies have been established at several low-decile schools in urban areas with large concentrations of *iwi* members. The aim of the project is to deliver online training opportunities to *iwi* members wherever they are located.

Other groups that may have limited access and familiarity with ICT include senior citizens and those leaving school without a tertiary qualification. SeniorNet,[16] a community-based initiative that began in the USA in 1986, has been operating in New Zealand since 1992. There are now 77 SeniorNet Learning Centres throughout New Zealand offering a range of Internet-based learning and communications services. While the organisation was initiated by Telecom New Zealand, the Learning Centres are managed and largely funded by the local membership.

The needs of the younger group have begun to be met only more recently. Several regional polytechnics have begun offering entry-level programmes in computer and Internet literacy at no cost to the students. The institutions find that by scheduling these classes outside normal teaching hours they are able to take advantage of existing facilities and meet their costs from the government fee subsidy alone. They also hope that these courses will attract a proportion of young people back into tertiary education, and some institutions offer pre-employment and bridging courses through this means.[17]

At a national level, the government is committed to "closing the digital divide" through co-ordinating the activities of government and public agencies.[18] While many of these activities are initiated by education agencies pursuing educational objectives, others are providing an educational service in support of some other objective. For example, the Community Employment Group strategy combines the efforts of eight government departments to use ICT to support disadvantaged communities and build employment opportunities.[19]

Constraints on the use of ICT

Earlier it was claimed that infrastructure and end-user access have not been the most significant blocks to the developing use of ICT in the New Zealand education system. There are a set of challenges that pose a greater risk to this development if they are not managed successfully:

- The first challenge is posed by classroom teachers and their ability and willingness to embrace the new technology. If ICT is viewed as a technology to bypass the teacher and to "teacher-proof" the curriculum, it will be resisted by teachers and ultimately fail. In general, policy-makers are aware of this danger, and implementation strategies at both national and international levels recognise the central role of teachers as active managers of the e-learning experience.

- A second challenge is to encourage greater collaboration and sharing among educational providers at all levels of the system. This is necessary to take advantage of the economies of scale that are available through ICT and the shortage of specialised talent and resources in the area. It will not be easy to achieve in an educational system that has been developed in an environment of competition.

- A third challenge is to achieve an appropriate balance between central steerage and institutional autonomy in the exploitation of ICT. As with the previous factor, there are a number of opportunities that can best be addressed by a well-resourced central initiative. Government and other funding agencies need to be

careful that such unilateral initiatives do not compromise the level playing field that successive governments have insisted on.

- A fourth challenge will be to ensure that the efforts of the educational sector to make the best use of ICT are taking place in a context of supportive public policy and infrastructure. The deregulation of the economy, and the telecommunications industry in particular, that took place during the 1990s has provided an efficient infrastructure to support a growing ICT industry. A national ICT taskforce has been set up to encourage investment in ICT projects.[20] Another important contextual element is the government's e-government strategy.[21] The aim is to structure and deliver government services online wherever possible. The early work on system architecture, metadata standards, interoperability and security is proving important to the widening use of ICT within the education system.

Analysis

From the point of view of the ICT enthusiast, the telecommunications industry and sometimes even the New Zealand Government, the developing use of ICT by the New Zealand education sector may appear less than dramatic – even timid. The sector has used it adaptively and within the context of existing structures of institutional provision, rather than as a spur for revolutionary change in the ways in which educational services are structured and delivered. The technology has not displaced the classroom teacher as the key manager of the learning process. Teachers and institutions still retain control over when and how the technology is employed and frequently continue to play a major role in developing ICT courseware. The challenge for the next few years will be introducing a greater degree of steerage in the developing use of ICT, encouraging greater collaboration and resourcing a few projects at a national level without alienating the present very high level of commitment and sense of ownership of institutions and teachers.

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Niue

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Niue is a raised coral atoll northwest of New Zealand. It has a land area of 260 square kilometres and a population of 2,113 (2002), which is mostly bilingual (English and Niuean). It is a self-governing nation that is part of the Commonwealth and is in free association with New Zealand. The main administrative centre is Alofi where the parliament sits and where the government ministries, shops, government secondary schools and the USP Centre are located. The Niue economy is based on fish, agriculture, some tourism and remittance from Niueans living overseas. The currency used is the New Zealand dollar. Niue is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

The Government of Niue states the following as its information and communication technology (ICT) policy vision:

The government envisages a Niue where every member of the community has affordable access to the information economy in order to enhance quality of life. Greater access and familiarity with the information and communication economy will contribute to economic development through the learning of relevant ICT skills, protocols and opportunities. Concomitant with government initiatives to up-skill Niue's workforce [is] Niue's growing ICT-related labour market [to] provide one of the prerequisites to the creation of an indigenous ICT industry. Over the medium term, an indigenous ICT industry will create a significant level of economic activity, as well as [provide] employment opportunities of the necessary profile to assist in retaining residents in Niue.[1]

The policy goals relevant to education are as follows:

- Structure educational policy to contribute to the creation of an ICT workforce
- Train and retrain the workforce to benefit from the opportunities presented by the ICT economy

Other policies relate to investment incentives for the ICT industry.[2]

A National Information Technology Committee was formed in June 1999 to advise the cabinet on strategies to create an ICT industry in Niue.

Current level of ICT access and use

Connectivity, Telephones, Fascimile

The Internet Users Society Niue (IUSN) was set up in 1997 to provide free Internet services to the people of Niue. It linked Niue to the World Wide Web through a server in New Zealand by a 64 MHz telephone connection leased from Telecom Niue. Over the years, usage has increased dramatically and there is at present a need for an increase in bandwidth to cater to the demand.

WiFi (Wireless Connection) was launched earlier this year by IUSN. This increased bandwidth to about 256 MHz, but at the time of writing, IUSN and the government were not in agreement over the legality of the operation and the Internet connection had been severed. (See also *www.wifination.nu.*)

Telephones and facsimile are widely used for both internal and external communications. However, the infrastructure is unable to fully support ICT. At present, Internet access in the outer villages is limited due to limited trunk lines made available by Telecom Niue for Internet access. Also, the outer villages are operating on a cell phone system that is not really compatible with Internet connection. Thus, upgrading of the existing services is an economic issue.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students only. Students of the distance and flexible learning courses of the university can communicate directly free of charge with their lecturers and other students by e-mail or through the two types of teleconferencing: video and audio. In addition to print courses, USP students can also enrol in the video broadcast courses and join in the lectures that are being delivered on Laucala campus. There are also Internet courses that are currently limited to the Law School and are taught from the USP Campus in Port Vila, Vanuatu.

Tapes of video broadcast sessions and audioconference tutorials are available on request by the Niue Centre to the Suva headquarters of the university.

Computer Use, Internet, E-mail

All schools, seven primary and one secondary, are government operated. Students have access to computer technology although it's more for the secondary students. Computer studies is a part of the syllabus at the secondary level from year 7 through to year 12 (forms 1 to 6). Internet access is still very limited, however, with only a few PCs connected, but a proposal has been submitted to enable all PCs in the school to be networked, which should at least improve connection capabilities.

With the inclusion of New Zealand form 7 studies in 2004 at the Niue High School, the need for Internet access is a priority to access materials from New Zealand Qualification Authority, and for general student research.

Broadcast Technologies

Radio and television stations operate daily services. Both radio and TV are operated by the state-owned Broadcasting Corporation of Niue.

Television licences are about US$ 40 every quarter. Programmes on TV are received via satellite from TVNZ and either broadcast live or recorded for later showing. Programmes are also received via satellite from the AsiaPacific Network in Australia. There are no specially made educational programmes, but there are two educational programmes from the AsiaPacific Network: the

"Y" which is science-oriented and looks at science concepts and theories through experiments, and a programme that looks at major historical events and explains what happened.

Satellite TV has just recently been offered in Niue by a private business that goes by the name of nuSatTV. There is talk that online learning will be made available to Niueans soon through the private sector, but as of the time of writing, that seems no more than rumour.

Major initiatives

USPNet

This partnership is between the university and Niue through the exemption made by the telecommunication organisation to allow the system to operate privately. USPNet is a 12-country satellite system and its current capacity has made it possible for Niue students to complete programmes while continuing to work and without leaving their families. Hence it offers economic advantages.

Satellite Link

In the 1980s to the early 1990s, some training courses were conducted using audio conferencing on a satellite link between Niue Agriculture/Fisheries Department with Samoa and Hawaii. This satellite system, however, is no longer in use.

Examples of training

In the non-formal education sector:

- Niue teachers are trained in New Zealand colleges where ICT training is incorporated into programmes.
- IUSN produces Internet training videos that are available to the public free of charge.
- Short-term courses are offered to the general public through the USP Centre. The courses include training in MS Word, MS Excel and PowerPoint. Other courses on databases are planned to be available soon.
- Government-run workshops on web design, as well as other software matters, are also usually available to the public.
- Continuous training and development needs were identified at a workshop held in July 2001 on National ICT Strategy. Staff development is a top priority, utilising existing institutions like the Niue High School, USP Centre, and government.
- Consultants and experts conduct workshops and training courses on ICT. They are usually sent to the island by aid agencies on the request of government.
- An IUSN volunteer is attached to the Information Systems Office of the Niue government to assist in developing software and databases. He is also responsible for training local staff in programming, website creation and maintenance of PCs.

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in Niue:

- The infrastructure is unable to fully support ICT.
- Limited trunk lines are made available by Telecom Niue for Internet access.
- Outer villages operate on a cell phone system that is not really compatible with Internet connection.
- People with ICT expertise are difficult to attract to Niue due to a lack of incentives in their work environments.
- There is a lack of government funding and other support and limited institutional capacity.
- ICT equipment and services are expensive.

Analysis

It appears that the desire to develop ICT, and the vision that "every member of the community has affordable access" are at odds with the infrastructure capacity and the costs involved in setting up computers and Internet access. While there can always be more emphasis on training, this does not appear to be as significant as many of the other constraints mentioned. Thus, if any assistance is to be given, there should be some emphasis on reducing those constraints regarding the availability of PCs and reducing the cost of Internet access.

NOTES

1 From the "National ICT Strategy Workshop Report, 2001". The official report on ICT in Niue is yet to be completed and most of the information in this paper is based on this report from the "Workshop for National ICT Strategy, 23-27 July 2001", held in Alofi, Niue. This workshop was facilitated by Taholo Kami, who is an IT consultant with Kami Communications. The participants were heads of department and senior management staff, cabinet ministers and members of the legislative assembly, representatives from the church and the private sector.

2 See note 1 above.

Palau

ICT USE IN EDUCATION

Mr Andrew Kerr

National policies, strategies and programmes

The Republic of Palau is an independent island nation located 500 miles southeast of the Philippines and 900 miles west of Guam. A former UN Trust Territory of the United States, Palau gained its independence in 1994, entering into a Compact of Free Association with the United States. As a result of the Compact, Palauan citizens use US currency and have unrestricted travel privileges throughout the United States and its territories.

Although Palau is a 400 mile-long archipelago with hundreds of islands (most uninhabited), the bulk of its 19,000 populace is located on the capital island of Koror. Because Palau has a dispersed population over several island groups, however, communication options can be limited for those living outside of Koror and the immediate area. While Palau is a young nation, it has a strong ICT infrastructure and several telecommunication options, although these are limited due to the remoteness of the island groups and lack of satellite availability. As part of the national technology plan of Palau, every person is to receive universal access to telecommunication, regardless of their location. The national telecom company, Palau National Communication Corporation (PNCC), has aggressively pursued this goal, resulting in the highest per capita penetration rates in the Pacific with services including phone (landline and cellular), Internet and television.

The two languages of Palau are Palauan and English. Japanese is widely spoken as well, as Japan administered Palau until the end of World War II and has a large tourism and fishing interest in the country. Public education is mandated from the age of six through 16. Grades are modeled after the American system with primary school consisting of grades 1 to 8, and high school consisting of grades 9 to 12.

Throughout the islands of Palau there are 22 public elementary schools, one public high school, two private elementary schools and five private high schools. There is also one institution of higher education, Palau Community College (PCC), which offers two-year associate's degrees and a variety of vocational education and adult education opportunities. PCC is also partnered with several universities, including San Diego State University (SDSU) and the University of Guam (UOG), which allows students to pursue bachelor's, master's and doctorate degrees without having to leave Palau (or leave for limited amounts of time during the summer).

Current level of ICT access and use

In 2001, Pacific Learning Services (PLS) reported that Palau has a high level of computer penetration in all of its 23 public schools with an average of 11 students per computer. Technology and technology literacy are considered high priorities of the Ministry of Education (MOE), and as a result every school has at least one computer lab and a computer lab manager. Teacher training in technology literacy has been ongoing and mandatory for all teachers. However, computer labs remain underutilised and many are limited to use for drill-and-practice programmes or games. In response, the MOE has been aggressively pursuing new training programmes for teachers and has drafted an educational technology plan designed to address teacher deficiencies in technology literacy and basic technology skills, as well as provide guidelines for technology programmes and integration into curriculum. These initiatives have resulted in increased usage of computers and technology integration across multiple disciplines, but low-bandwidth Internet access continues to pose a problem for schools.

The majority of computers in Palau schools use the Apple Macintosh platform. Windows platform computers are mostly limited to MOE administration staff, PCC and high school business classes. The MOE has videoconferencing capability and utilises the system to communicate with Hawaii and other US affiliates on a regular basis for professional development and administrative meetings. Two videoconferencing units are also in remote schools, but as they work through PNCC instead of the MOE's satellite-based system, operating costs are too prohibitive to warrant usage. To date the two units remain functional but not in operation.

Remote schools also have computer access. Most of the remote island groups have at the minimum semi-regular power that allows for the operation of computers labs. The very remote island groups rely on solar power for computer access. Internet and other telecommunication services, however, are limited or non-existent in these islands.

Major initiatives

Teaching, Learning, Technology Training Project

The Teaching, Learning, Technology Training Project was designed not only to bring technology to the students and teachers of Palau, but also to bring new strategies for teaching and learning. Building on the Palau 2000 Master Plan for Education Improvement, the project used a curriculum integration model that encourages student-to-student and student-to-teacher interactions, a model in which the mimetic approach to education gives way to a constructivist approach. The expectation was that through these changes a learning environment would be created that prepared students to deal with uncertainty, complexity, information resources, new technologies and different cultures.

The training was designed and conducted by a consultant from Guam and required a significant commitment from those who enrolled. Initially, participants took part in an intensive weeklong programme in Koror, followed by monthly day-long sessions over a period of six months or longer. Through the training teachers were exposed to a broad overview of computer operation, maintenance and use in the classroom. Content addressed included the operation of specific software products (e.g., Hyperstudio, Kidpix) and various strategies related to integration and use (e.g., lesson planning, co-operative learning).

Under the Teaching, Learning, Technology Training Project, a framework for professional development for teachers and school principals was developed as a process intended to improve skills, attitudes, understanding and performance. The process was structured around a series of courses/institutes designed for teachers to acquire identified skills and then apply and evaluate them using a problem-solving/sharing approach. The courses/institutes were used, and continue to be used, as opportunities for teachers to discuss, think about, try out and hone new practices. This form of professional development was key to the successful use of technology in education for improved student achievement.

The following technology competencies were identified as critical components of this professional development process: technology awareness, technology identification and operation, applications, academic skills development, cognitive skills development, acquisition of information (research), presentation/production skills, interpretation skills, ethics and technology in the community.

These technology competencies were aligned with five stages of technology application, derived from the Apple Classroom of Tomorrow (ACOT) research studies, through which it was hoped all of Palau's teachers would pass.

- **Entry stage:** Teachers struggle with the changes education technologies bring to the classroom environment. They are required to rethink teaching and learning styles, develop a new technology vocabulary and investigate new tools for learning. Initial experiences with technology characterise this first stage of technology awareness.

- **Adoption stage:** The struggle to accept new technologies is replaced by the struggle to master them at the most rudimentary levels. Fear is replaced by experimentation with electronic applications that closely imitate existing classroom activities, such as drill-and-practice and tutorial environments.

- **Adaptation stage:** Teachers recognise the potential and power of technology tools to the extent that they use them for personal productivity and begin to advance student usage of these same tools. Examples include the usage of word processing in writing assignments, database in social studies research and data collection and spreadsheet integration into the math and science curriculum.

- **Appropriation stage:** Teachers master specific technology applications and seamlessly integrate them into daily instructional and management activities within the school environment. Teachers at this stage are a valuable resource to their colleagues. They help implement the "teacher-training-teacher" and mentoring models for professional development activities.

- **Invention stage:** Teachers are technologically proficient and provide students with necessary technology skills and access to these powerful resources. Teachers at this stage can develop sharable courseware and materials that link technologies to current curriculum or education reform components while they teach technology to others.

Each of these stages was linked to curriculum integration so teachers could select appropriate instructional activities relative to their existing skill set and professional growth plans. As professional development took place and teachers began integrating technology, they were expected to progress through each stage over an extended period. The phasing-in of the professional development offerings at all stages of integration was expected to result in the majority of teachers reaching the invention stage. Structured teacher training programmes continue to be regularly offered by the MOE and teachers are encouraged to enroll.

PRELStar: US Federal Star Schools Project

Through PRELStar, the MOE and Emergency Management System were able to connect to the Peacesat satellite network with 128 MB videoconferencing capability. This allowed the MOE to connect (free of charge) to a multitude of other sites across the US-affiliated Pacific (including Hawaii, Guam, the Northern Mariana Islands and American Samoa). This system also allowed Palau to connect to any other videoconferencing system throughout the world via a relay system in Hawaii (at a cost). PRELStar also provided training.

*PR*TEC: US Federal Regional Technology Consortia Project*

PR*TEC provides technical training and support through PREL and assists the MOE in a variety of technical training. Major initiatives included providing support and guidance in the formalisation of a Palau Technology Education Plan to include technology standards and benchmarks for students, teachers and administrators, and creating a basic teaching credential that teachers can receive via distance technology. A current problem for the MOE is the lack of qualified teachers. This programme, a collaborative effort with PCC and other public institutions of higher learning in the US-affiliated Pacific, allows teachers to stay employed and on-island while taking courses towards certification.

Sasakawa Peace Foundation

The Sasakawa Peace Foundation of Japan has funded a number of technology and distance learning studies through the University of Hawaii and the University of Guam. Grant awards have allowed both universities to convene meetings for the former Trust Territories of the United States (Palau, Micronesia and the Marshall Islands). These meetings and

various reports have resulted in technical infrastructure data, needs assessments and distance learning plans for each island nation.

University of Guam: US Department of Agriculture Challenge Grant

Through a grant from the US Department of Agriculture, the Univeristy of Guam, in partnership with local institutions of higher learning and Florida A&M University, have created a series of distance learning programmes designed to assist agriculture teachers across the former Trust Territories of the United States. A series of modules were produced in both online and CD-ROM format and offered for university credit. The result is for participants to be trained in science and agriculture methods to improve both curriculums.

Examples of training

As part of its Compact of Free Association with the United States, Palau is entitled to participation in many US federal grants and programmes. These have allowed the MOE to vastly expand their services to teachers. Two major programmes are provided through Pacific Resources for Education and Learning (PREL), a Pacific-based, non-profit education corporation.

The first, PRELStar, is a distance learning programme designed to build telecommunication capacity in the US-affiliated Pacific. PRELStar has provided distance learning training to teachers, administrators, government and health workers for more than five years. Areas of training have included how to set up and maintain satellite earth stations, Internet usage for education and health purposes, videoconferencing training, educational and health distance learning programmes, and computer/media troubleshooting and repair. The result has been an increased capacity of education and health workers to access ICT services. PRELStar also funded a distance learning master's programme for the US-affiliated Pacific in instructional technology. The result was two professionally trained instructional designers to assist MOE and PCC teachers with technology integration.

The second programme provided through PREL is the Pacific Regional Technology in Education Consortium (PR*TEC). Like PRELStar, the PR*TEC offers distance learning training and support, but also provides technology literacy training for teachers and students, technology policy assistance and computer repair programmes. Work for the past three years of the PR*TEC in Palau has resulted in computer lab managers trained in integrating technology into the curriculum and repairing computers, a draft technology plan for the MOE and technology standards for teachers, students and administrators of the MOE.

Constraints on the use of ICT

Limited Access to Internet

The MOE's current telecommunications infrastructure is limited by the high cost of telecommunications within Palau and by the capacity of that infrastructure to support broadband services to schools. While schools have access to computers and other technology, only some have dial-up Internet access. They dial in to the MOE through a six-modem modem bank. From there, the MOE is connected via a 64 kbps dedicated connection to the PNCC. This level of service limits each school to no more than three concurrent users. As a result, technology use in schools is limited to those activities that do not require Internet access. According to Pacific Learning Services, these activities involve the preparation of lesson plans by teachers and papers and reports by students. Only a relatively small number of teachers are using computers, laser discs or projectors as part of their instruction. Thus, few teachers have integrated technology into their instructional practices and rely on the computer for drill-and-practice programmes or for classroom management activities, such as grade books and class lists.

Limited Bandwidth Capacity

PNCC is currently the only provider of telecommunications services in Palau. It has an Internet link that provides only 2 mbps downlink and 768 kbps uplink capacity. Although the company has installed a caching server, traffic on the link runs at 80 to 90 per cent capacity. At peak periods of the day, the link appears to be completely saturated, resulting in the inability to access services or very slow response times when service is available. Although a fibre ring connecting Koror with the largest island of Babeldaob provides increased service, it too is running near capacity.

To increase bandwidth capacity, Palau is currently pursuing funding for a fibre cable to link Palau with the state of Yap (in Micronesia) and the US territory of Guam. High-level agreements are in place and preliminary planning is being conducted by NTT, a Japanese telecommunications company. The estimated costs for laying the cable begin at between US$ 50–60 million. Cable maintenance costs are estimated at US$ 750,000 per year plus US$ 35,000 for each day the cable maintenance ship is at sea. In addition, there are considerable start-up costs. No funding for this project has been secured to date and PNCC estimates that operating costs alone would require a six-fold growth in the company's revenue base.

Bandwidth for Schools

The use of ICT to support education requires broadband Internet access. A full T1 access would best serve the needs of the MOE, but the cost of such access would require significant outside funding. The most cost-effective design for providing Internet access to schools involves the collaboration of the MOE with PNCC and/or other Internet service providers (ISPs) to establish a wide area network connecting schools with the MOE, a caching server at the MOE and dedicated Internet bandwidth of at least 512 kbps from the MOE to the ISP. The use of a caching server will lessen bandwidth demands and provide for higher speed response times for Internet sites accessed by multiple users. This architecture will allow for future upgrades in Internet connectivity as additional bandwidth becomes available.

Analysis

While Palau is far above the norm for computer access in education for the Pacific, the MOE would still like increased Internet access, a smaller computer-to-student ratio, higher technology literacy for teachers and students and technology integration into the curriculum. To accomplish these goals, the following recommendations may be considered.

ICT Access

Palau telecommunication infrastructure is currently under the monopoly of the PNCC. Under the current universal access plan, the high rates of the PNCC for subscribers actually subsidises the very high operating costs of providing services to remote areas of Palau. Because of this, a private company is considering offering ICT services with its own teleport to bring additional bandwidth to Palau and concentrate on the main population centre of Koror. This would provide lower-cost, high-speed Internet access to the largest portion of the populace. If this were to happen, the current model of universal access to Palau would be disrupted, as many customers would opt for the higher speed and cheaper cost of the private company.

A benefit for the MOE, however, would be better Internet access for the administration and schools. The lower costs would also allow them to purchase more computers under the same budget, as the money previously spent on Internet access could be redirected to equipment.

Technology Literacy for Teachers and Students

Under the current technology plan for the Palau MOE, technology literacy has been defined and categorised. However, to implement a plan that will ensure technology literacy for all students and teachers, time must be allocated for staff development and benchmarks must be assigned for students at each grade level. Technology literacy is a building process and should be consistent for students and teachers. Teachers must have a clear understanding of what is required to be technologically literate and be provided ample professional development opportunities to achieve it.

Technology Integration

Technology integration differs from technology literacy: the latter refers to specific skills, while the former refers to the application of those skills in different disciplines. Professional development opportunities for teachers should be provided on how to integrate technology into different subject areas, such as Math, Science, Palauan and English. Computer access should also be provided.

Papua New Guinea

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Papua New Guinea (PNG) lies north of Australia. It comprises the eastern half of the island New Guinea as well as many offshore islands, with the main ones being New Britain, New Ireland and Bougainville. It has a total land area of 461,690,33 square kilometres and a population of 5,100,000 (2002 figures).[1]

Politically, PNG is an independent state and a member of the Commonwealth of Nations. The administrative centre is Port Moresby,

located on the southern coast of the main island. Economically, the country produces copra, cocoa, coffee, vanilla, sugar, timber and fisheries as well as oil, copper, gold and natural gas. It has a small but growing tourism industry. The monetary currency is the Papua New Guinea Kina.

There are more than 800 known languages but English is the official language of government and business. Melanesian Pidgin and Police Motu are also used widely. Through recent legislation, all the 800 languages of Papua New Guinea have become official languages of instruction at the elementary school level.

National policies, strategies and programmes

The PNG government has a centralised information and communication technology (ICT) budget,[2] and there have been some attempts to develop and launch an ICT policy in the country. However, these have all been unsuccessful due, in part, to the ad hoc way of mounting projects which has resulted in incompatible appliances and applications being installed, as well as different ICT approaches on the part of many donors.[3] There has been a copyright law passed by Parliament that is now in effect, and there are plans to develop a government intranet and to put key dates and statistics and library material onto CD-ROM.

There are two government websites (see *www.gov.pg* and *www.pngonline.gov.pg*) as well as the prime minister's own website (see *www.pm.gov.pg*). Other government departments and statutory bodies also have their own websites.

Current level of ICT access and use

Telikom PNG is a government-owned organization and has a monopoly on telecommunication services, with 66,000 customers in 2002. As well, a high-capacity, 11-megabit private sector wireless telephone network has been introduced for government services.

A survey conducted in 2002 revealed that five organizations used telephones, facsimiles, and Internet on a daily basis as well as some audio conferencing at least once a month. Here are some of the views of the organizations surveyed:

- "ICT development is ad hoc and there needs to be a blueprint for ICT development so that change is uniform and not staggered."
- "In PNG we do not really have an ICT infrastructure."
- "PNG needs as much help as possible otherwise it will get lost."[4]

PNG has multiple Internet service providers (ISPs), which include Daltron Electronics, Datec, Global, Online South Pacific and High Tech Industries. There are 10,000 Internet subscribers and connectivity is affordable with excellent service in the urban areas.[5] There is still a monopoly over the licensing of ISPs by Telikom PNG.

The major centres of population, Port Moresby and Lae, have access to computers and the Internet either through work stations or through education institutions. There are over 10,000 public servants in PNG, a third of which are in Port Moresby, but with the exception of a few departments, the level of computer literacy is generally quite low.

PNG is home to the following educational institutions:[6]

- Over 3,000 primary schools (800,000 students);
- 170 high schools (56,000 students);
- Nine technical colleges (9,000 students);
- 124 vocational schools (7,000 students);
- Eight teachers' colleges (4,000 students);
- Six universities (10,000 students), comprising University of Papua New Guinea (UPNG) in Port Moresby, University of Technology in Lae, Pacific Adventist University in Port Moresby, Divine Word University in Madang, University of Vudal in Rabaul and University of Goroka in the highland town of Goroka; and
- The College of Distance Education (CODE), a large distance education institution for the school-age population.

UPNG and University of Technology both provide postsecondary and bridging-type programmes, and along with Divine Word, UNPG also offers tertiary programmes through the distance mode. UPNG is also partnering with Telikom PNG in a venture through which the university is moving into multimedia distance education through 14 regional centres. The demand for further education is high in regional areas where learners are unable to go beyond the grade 12.

In 2002, the education sector had 2,000 telephones, 50 mobile telephones, and the following breakdown of computers, of which 100 were over three years old and 30 were not functional:[7]

- 300 production computers;

- 160 administrative computers; and
- 80 Internet computers.

UPNG has computer labs in each of its five regional open campuses based in Mount Hagen, Madang, Kokopo, Buak and Port Moresby. Each lab has 20 computers networked to the UPNG intranet system. Furthermore, on the main campus at Waigani, the university has three computer labs with 200 networked computers in each lab. The labs are housed in the Michael Somare Library and the Mathematics Strand of the School of Natural and Physical Sciences. Almost all academic staff at UPNG have networked PCs. The Department of Education plans to increase its existing computer network systems, develop a website, provide specialist training for information technology staff and provide audio and video conferencing to some remote schools on a trial basis. There are also plans to develop a government-owned network on Education and Research Network (ERNET) that will encompass and link all of the universities and major tertiary education and research institutions throughout PNG.

Broadcast Technologies

Radio. Radio plays a major developmental role in Papua New Guinea with its difficult terrain. There are four types of radio services with the main one being the government-owned National Broadcasting Corporation (NBC). The NBC operates the two national services on the AM and FM bands with the FM service being its commercial arm, Kalang FM. The AM service is the government's public service station through which all basic education school programmes are broadcast every morning. For some of the remote students in the country, this is the only form of contact with the outside world.

The NBC also operates 19 provincial radio stations that air programmes ranging from news to government extension services and community awareness. They use the local dialects as well as Melanesian Pidgin. Most provincial radio stations are old and the equipment needs replacing. The Japanese government has assisted with the replacement of radio stations in some provinces.

There are also four private radio stations that broadcast on the FM band using a mix of the three main languages of Papua New Guinea. The latest addition is PNG Christian Broadcasting Network, a Christian radio station.

Television. Papua New Guinea has only one TV station, EMTV, which is a subsidiary of Channel 9, Australia. Most programmes are imported from Australia, although there is some local content with news and locally produced documentaries. Other overseas TV stations can be received by satellite with the proper satellite receiving dishes. Most urban centres have cable TV providers for people who can afford it. These include overseas channels as well as others.

The Papua New Guinea Education Department uses EMTV to broadcast primary and secondary school subjects during non-peak hours each day. The Department's Education Media Centre, funded by the Japanese funding agency (JICA), produces these programmes using actual class situations in schools. The Centre is currently supported by Japanese volunteers who work in a support role, providing training to local staff.

Major initiatives

Japan International Cooperation Agency (JICA) funded solar power for 350 schools that started in 1998 and are still operational. These came with lights, TV, VCR and a PC.

The Media Centre, described above, is another major initiative.

Examples of training

Telikom staff have received basic, intermediate and advanced computer training and 500 are now confident with ICT and computers.

In the Department of Education, 150 of 733 staff are confident in using ICT and computers. One hundred have been trained recently, and 300 are learning computer skills on the job.[8]

Constraints on the use of ICT

The following constraints were identified at the start of 2002:[9]

- High cost of equipment;
- High cost of domestic and international telecommunications;
- Unreliability of power supply, poor quality of Internet connections and the high cost of telecommunications for communications nationally and internationally;
- Poor access to telephone networks;
- Lack of skilled support services; and
- Lack of bandwidth.

Analysis

Obviously, the broadcast media are of vital importance for PNG education. Both radio and television are being used and the Media Centre, installed by the Japanese, is a significant resource that needs to be maintained appropriately along with adequate staffing resources.

Priority areas identified are introducing distance learning on a large scale at K-12, technical vocational and tertiary levels; accessible and affordable rural telecommunications services (which could be included under the new Community Services Trust Fund which is to address the provision of services to remote communities); and cross-cutting ICT policy for government. The last would be very helpful in the area of education as it would facilitate the development of the Education and Research Network as well as support telecommunications and ICT policy and regulatory development and overall capacity building.

The initiative by JICA that supplied schools with solar power along with other equipment could be considered as a model to increase connectivity and access for schools in the rural areas.

NOTES

1 "Internet Infrastructure and e-Governance in Pacific Islands countries" (UNESCO, 2002), Appendix 15. This information was obtained from a survey of the Department of Education, National Cultural Commission (NCC), Pacific Mobile Communications (PMC), South Pacific Post Ltd, and Telikom PNG.
2 See note 1 above.
3 "Information and Communication Technology in the Pacific," Report TA REG 5990 (Asia Development Bank, June 2002).
4 See note 1 above.
5 See note 3 above.
6 See note 3 above.
7 See note 1 above.
8 See note 1 above.
9 See note 1 above.

Samoa

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Samoa comprises seven islands of volcanic origin, with a land area of 2,860 square kilometres. The population of 179,466 (2002) is Polynesian and largely bilingual (Samoan and English). Five of the seven islands are inhabited. The main island of Upolu is where the capital Apia is located, as well as the parliament and government ministries. Apia, with a population of about 38,000, is also the commercial centre and the location of the campuses of two universities (University of the South Pacific (USP) and the National University of Samoa), Samoa Polytechnic and two theological colleges. Most of the country's schools are also on Upolu.

The other major island is Savaii which has a population of about 41,000. A number of secondary and primary schools are located on this island.

The Samoan economy is based primarily on fish, some manufactured goods, tourism and remittance from Samoans living overseas. The currency used is the Samoa Tala.

Samoa is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

Samoa National ICT Policy[1]

Samoa has a national information and communication technology (ICT) committee chaired by the CEO of the Ministry of Post and Telecommunications. Members of this committee include key ICT experts and representatives of educational institutions. The committee has established a website (see *www.e-samoa.ws*) which outlines policies and strategies for Samoa.

The Samoa ICT Policy Vision is "information and communication technologies for every Samoan." It follows the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan – a regional ICT strategy agreed and signed by the Ministers of Communication of each Forum member country. The Vision for Samoa includes statements of guiding principles in each of four areas of development. Policy statements have been developed within each area with respect to implementation. For example, the guiding principle statement and related policies in the area of human resources are as follows:

> *ICT will be used to inform and connect the population of Samoa and ensure that it benefits from flexible and appropriate education, training and experiences.*

- **Policy 1.1:** Awareness of ICT and the need for computer literacy at all community levels will be promoted and developed.
- **Policy 1.2:** Samoa will attract, develop and retain a knowledgeable ICT workforce that will be able to contribute to the maintenance and further development of ICT and in the process reduce professional isolation of Samoans at all educational levels.
- **Policy 1.3:** Everyone will have opportunities to access ICT [with special regard to women, the disadvantaged, the disabled, under-represented minorities and those in rural and remote areas].
- **Policy 1.4:** Samoa will promote and encourage its people to contribute to the global economy through ICT.

The other three statements of guiding principles are as follows:

Infrastructure Development: Appropriate ICT infrastructure [will be developed] to support development for Samoa.

Co-operation Between Stakeholders: Easy access to information through ICT will strengthen co-operation between stakeholders while advocating the Statement of Economic Strategy (SES) championed by the Government of Samoa to ensure good governance, development in the private sector and improvement in service delivery.

Appropriate Policy and Regulation: Easy access to information through ICT will strengthen co-operation between stakeholders while advocating the Statement of Economic Strategy (SES) championed by the Government of Samoa to ensure good governance, development in the private sector and improvement in service delivery.

Further, the Ministry of Education, Sports and Culture (MESC) has developed an Information Technology Strategic Plan 2000–2003[2] which looks at managing ICT to ensure the ministry properly meets the needs of stakeholders. This plan includes the management and operation of an ICT system, not only for ministry functions, but also for the schools system. It has been developed around 19 issues that include Internet access for both the ministry and the schools, hardware/software, an ICT steering committee and staff training. Thus there are strategies to implement the ICT policy that include promoting greater awareness of ICT; developing and retaining a knowledgeable workforce in ICT; developing and maintaining training policies and programmes to ensure ICT resources are properly managed; providing equal access to ICT, bearing in mind that there must be measures in place to reduce inappropriate use; developing ICT infrastructure to promote universal access; addressing affordability of ICT technology; and continually evaluating ICT plans and their impacts.

Current level of ICT access and use

Connectivity, telephones, facsimile

Since 2002, the telecommunications corporation has changed from Samoa Communications Ltd. (SCL) to Samoatel. The new management has made changes that have

increased the number of connections. The Samoa telephone infrastructure is extensive in the Apia urban area and fibre optic lines have begun to be laid to enhance connectivity for the national university and Samoa Polytechnic. Fax communication is extensive.

Wireless communication is provided by Telecom Samoa Cellular. In September 2003, their service was extended to Savaii. The prepaid mobile telephone is their latest development. This means of communication is very popular in Samoa and it was used in a trial by the Ministry of Education in 2002. The trial involved the provision of mobile telephones to School Review officers to allow communication during the times of national and external examinations. The trial revealed the need for telephone communications as confirmed by the officers, and proved to be of great use during this important time in the education cycle.

Computer Use, Internet/World Wide Web for Education, E-mail

There are 205 schools in Samoa, 166 of which are government operated. Of these, 141 are primary schools and 25 are secondary. The others are mission or private schools, both primary and secondary. Until 2002, most government schools had limited access to telephones and, consequently, very limited access to the Internet. However, as part of its ongoing institutional development programme, MESC recently assessed the use of mobile telephones for district School Review officers and has also been negotiating with Samoatel for more landlines. It is expected that schools will have telephones installed during 2004.

A few schools have acquired computer labs through which pupils have Internet access, but these are only on the main island of Upolu. In January 2003, there were 336 computers in all mission, private and government secondary schools. Another 160 PCs were received from the ANZ Bank and these are being distributed to government secondary schools and a mission school, Chanel College. The Asia Development Bank (ADB) is providing another 54 PCs that will also be distributed to secondary schools, making for an average of 12 computers per secondary school. Fifteen of 43 secondary schools are currently offering computer studies at various levels. One primary school has a computer lab donated by JICA.[3] However, the majority of Samoan school children have still to see a PC at their school.

The newly opened Teachers' Resource Centre in Savaii (in the Salelologa public library) is equipped with five PCs, a fax machine, telephone and other office equipment. This resource centre is open to teachers, USP Savaii students and the public at large. In the same complex, the USP Centre has established an office for its students in Savaii, and there are plans to install at least three more PCs for use by students for both preparation of assignments and Internet access once the connection is made, expected to be by the start of 2004.

Samoa Polytechnic, National University of Samoa, and USP Alafua Campus all have computer labs for formal courses and training programmes. Other computer labs that are not school-based are those of the South Pacific Regional Environment Programme (SPREP), and the recently completed training lab for the Ministry of Health (see "Major Initiatives" below). All have Internet access.

Three ISPs provide services: Computer Services Limited, I-Pasifika, and Le Samoa. E-mail has started to become a popular means of communication, particularly in urban Apia. Hotmail and Yahoo accounts are the most popular because of their ease of access, even for USP Centre students.

Samoa also has a vibrant Internet cafe industry. These cafes are very busy with clients ranging from students to tourists to the general public.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students on Upolu only. Students of the distance and flexible learning courses of the university can communicate free of charge directly with their lecturers and with other students using e-mail, or through the two types of teleconferencing: video and audio. In addition to print courses, distance and flexible learning students can also enrol in the video broadcast courses and join in the lectures that are being delivered on Laucala campus. There are also Internet courses which are currently limited to the Law School and that are taught from the USP Campus in Port Vila, Vanuatu.

The university has devised a strategy by which students who miss a satellite tutorial/lecture are able to request tapes of video broadcast sessions and audio conference tutorials through the Centre. Indeed, video broadcast lectures can be re-broadcast and video recordings are also available at the Centre.

Broadcast Technologies

Radio and television stations operate daily services. The government corporation, Samoa Broadcasting Corporation, runs the television station, SBC1, and the AM radio station, SBC2. There are several privately owned FM radio stations which offer music, news and programmes of general interest such as interviews with visiting high-profile people.

The SBC1 television station has non-formal education programmes and recently ran a series on the use of ICT to commemorate the 25th anniversary of Computer Services Limited (a government corporation). SBC2 radio station airs a schools broadcast programme that has been in operation since the 1950s. This is a one-hour programme, targeted mainly at the primary level, and covering all subject areas.

Teachers' Distance Learning Via Radio

In 2002, a Ministry of Education project on distance learning was mounted for primary (year 4 to 8) teachers on the national radio station. The duration of the programme was half an hour, after school, for one year. The course was on methodology of teaching the core subjects and focused on particular areas of difficulty that teachers had identified through a needs analysis. There has been very positive feedback on the programme's usefulness and funds are being sought for further programmes of this nature.

Major initiatives

National University of Samoa Videoconferencing

Through a PEACESAT link, the National University of Samoa (NUS) has been able to receive distance learning courses for its nursing faculty and has also been able to provide courses on teaching mathematics to students in American Samoa.

World Health Organization/Ministry of Health Project

This involved the establishment of a computer lab for the training of medical personnel, beginning with distance learning for nurses. Completed in September 2003, the lab has 10 state-of-the art PCs, a server, web filter, printer and has been set up to be compatible with the existing computing facilities of the ministry. Two training workshops have been built in as part of the project. The first one covered the basics of Windows 2000 and Office 2000. The second training workshop on Advanced Applications will be undertaken in the near future.

Teachers' Resource Centre

The newly opened (September 2003) teachers' resource centre in Savaii has increased opportunities for teachers to use computers, though not yet for Internet access. The centre is the initiative of the Ministry of Education, Sports and Culture with funding from NZAid. It is expected to provide support to teachers in their teaching preparations and the location in the same compound as the library and the USP sub-centre provides an integrated support service to all users.

USPNet

This partnership is between USP and Samoa through the exemption made by the telecommunication organization to allow the system to operate privately. This 12-country satellite system and its current capacity has made it possible for Samoan students to complete programmes while continuing to work and without leaving their families, by accessing the university programmes through the USP Centre in Samoa. As mentioned elsewhere, the multimodal facility of the network provides different modes of learning experiences for the students including text, videoconference and audio tutorials with the lecturers in Fiji or Vanuatu. There are also online courses for the law programme which is based in Port Vila, Vanuatu. A recent development of the USP Centre in Samoa has seen the establishment of a sub-centre in Savaii, the other main island. It is envisaged that Savaii students will receive access to USPNet if planned negotiations with Samoatel are successful. This will allow student access to e-mail and teleconferencing, as well as Internet and videobroadcast courses.

Examples of training

Formal training programmes include those offered at the Samoa Polytechnic, NUS and USP which offer a certificate and diploma in computing. There are also short-term courses on Microsoft applications at Samoa Polytechnic, running in the evenings over five weeks. In 2002, NUS commenced the offering of CISCO training on technical aspects of computing.

Some training on computer awareness and basic and advanced applications of Windows and Office programmes are offered by some computing companies at a fee comparable to that charged at the Samoa Polytechnic.

There are plans by the ministry to provide computer studies training for teachers given that a curriculum on Computer Studies is being developed. To date, teachers have received short-term workshops on computers and their use. Some government departments and commercial organizations also offer short training workshops when the need arises.

In March 2003, a small computer company was set up in the commercial centre of Savaii to offer training to the general public. Unfortunately it was moved to Apia in September due to dwindling business prospects.

Teacher training is being co-ordinated by the Ministry of Education, Sports and Culture, in line with the planned schoolnet. Other teacher training for ICT is provided by the NUS where two core groups of up to 15 teachers will be trained in the use of computers in the classroom and in interactive learning materials design.[4]

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in Samoa:

- **Limited institutional capacity:** Apart from the tertiary educational institutions and some secondary

schools in urban Apia, there is very limited computer and Internet access throughout the country's schools. The vast majority of students therefore have not had much exposure to computers and what is offered by way of communication – and the main reason is the lack of facilities.

- **Expensive ICT equipment and services:** PCs and accessories are still very costly in Samoa. Not only are institutions unable to afford teaching facilities, but ownership of PCs is limited to those who can afford them. It is also not a priority when compared to the other more pressing and basic needs of a family. In addition, labour costs are high.

- **Infrastructure:** Recently the telephone system has seen improvements in its service and infrastructure; however, access is still very limited. More landlines are being laid, providing the opportunity for telephone connections for rural schools. Until these are completed however, schools have no access despite a desire to be connected.

- **Cost of educational programmes for broadcast:** The USP Centre and other institutions could use both radio and television more to support students; however, the cost is a major constraint.

Analysis

While a computer culture has developed in leaps and bounds in Apia, this is not the case outside the town area. The cost of hardware remains one of the major constraints. Schools especially have not been able to catch up because of these costs, as well as because of the lack of telephone connectivity.

The development of a computer curriculum is a positive move forward but it needs to be accompanied by the provision of facilities in schools, more trained teachers and greater availability of maintenance service providers. Hence if ICT use is to be encouraged, there needs to be facilities to allow for exposure and regular practice by students.

Broadcast technologies are at present underutilised for education programmes. It is an opportunity that could be exploited particularly given the availability of educational programmes on video and audiotapes. There are local video producing companies that could record educational programmes for broadcast. However, cost is the major limitation.

Given the success of the radio-based teacher training programme described earlier, a particular priority should be given to raise the funds needed to allow it to continue.

NOTES

1 See Samoa Information and Communication Technologies (SICT) website, *www.e-samoa.ws/*.
2 "A Path for Change," Information Technology Strategic Plan 2000–2003 (Samoa Department of Educational Institutional Strengthening Program, December 2000).
3 Ministry of Education, Sports and Culture Report, IT Desk, "Computer Studies Stock-take in Secondary Schools" (2003).
4 "Technical Assistance for Samoa Schoolnet and Community Access Pilot Project" (Asian Development Report, 2002).

Solomon Islands

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

The Solomon Islands have been plagued by internal strife and unrest in the past few years. National governance and policy have been fragmented and inconsistently implemented as a result. Development efforts have been hindered by ongoing ethnic tensions. International development agencies, such as the UN and AusAid, have been involved in efforts to resolve conflict and restore peace to the nation.

There is currently no national ICT policy in place for the Solomon Islands for any sector, including education. To address this, a workshop was held in February 2003, bringing together stakeholders to discuss the development of a national policy. People from the Solomon Islands government, non-governmental organizations (NGOs), the private sector, donor agencies and civil service organizations came together and an ICT working group was formed as a result. The workshop report contains details on the strategies and plans mapped out at this meeting.[1]

A key body involved in the development efforts in the Solomon Islands is the People First Network (PFNet). It has spearheaded the most significant ICT effort in the country, an innovative e-mail–based communication network reaching rural areas of the islands. Initiated by the United Nations Development Programme/United Nations Office for Project Services (UNDP/UNOPS) Solomon Islands Development Administration Planning Programme (SIDAPP), PFNet is part of the Rural Development Division (RDD) of the Ministry of Provincial Government and Rural Development and has been operating since 2001. This initiative is detailed in the following sections of this report.

The Ministry of Education is currently operating under an Education Strategic Plan that was put together for 2001–2004. This plan has not been implemented due to a lack of financial resources. In an October 2003 strategic planning workshop, the Permanent Secretary of the Ministry of Education, Dr. Derek Sikua, assured participants that the plan is being reviewed and continues to be supported by the government and donors. Funding for education is slated to come from the European Union and the New Zealand Aid Program (NZAid). Bilateral donors such as the Republic of China and Japan are slated to continue supporting education efforts in the islands.

Current level of ICT access and use

"Applying Information and Communication Technology to Education in Rural Solomon Islands," co-authored by key players in the Solomon Islands ICT and education efforts, provides recent and up-to-date information.[2] It is a comprehensive and detailed overview, containing in-depth analysis and recommendations for future ICT planning.

The report states that not many statistics are available on the penetration of ICT in education in the Solomon Islands and identifies the need for baseline data collection. A few secondary schools in urban areas have computer labs and computer-related courses. The use of computers in these schools seems to be guided more by far-sighted administrators rather than an informed strategy for use and development of technology in education. Only three schools (one an elite international school in Honiara) were identified as having computer access and related curriculum.

The two institutes of higher education operating in the Solomon Islands are the University of South Pacific (USP) Centre and the Solomon Islands College of Higher Education (SICHE). There are plans to open a USP campus in Honiara and the university has identified the need to promote ICT usage and education for its students. The USP Centre is linked to a satellite system that offers Internet links, videoconferencing and other facilities, though a lack of available PCs for students renders these resources underutilised. SICHE currently has no computer lab and is in a challenging financial state since the economic collapse that followed the ethnic conflict of the past few years.

The greatest use of ICT for education has been in a distance learning project between USP and a rural community school (see below).

Major initiatives

PFNet is a unique project that includes a systematic evaluation effort that provides insight into the successes and challenges of bringing ICT to the Solomon Islands. The project was a finalist in the Stockholm Challenge 2002 and was entered in the InfoDev ICT Story Competition 2002, two competitions that seek out the most ingenious uses of technology for the development of human life. It is considered an exemplary effort to bring ICT to rural areas to empower, educate and provide access and information to people.

Conceived and implemented by the UNDP/UNOPS project, PFNet is maintained in partnership with SIDAPP and is part of the RDD in the Ministry of Provincial Government and Rural Development. PFNet has been established as a non-profit organization.

The PFNet project includes three main areas: the establishment of remote e-mail stations creating a rural communication network around the islands, a related pilot project to provide distance learning courses to rural areas and an Internet cafe in Honiara.

PFNet has set up a short wave (HF band) wireless e-mail system aimed at promoting equity and access to rural areas in the Solomon Islands. The system has successfully connected islanders in remote areas and provided economic opportunity. It has promoted communication between dispersed families, increased access to health and education resources and created the opportunity for rural islanders to conduct business and commerce with urban areas such as Honiara. The low cost to the end user of the system makes it more accessible to the average villager than radio telephones, which are more commonly used in remote Pacific islands. Research and evaluation conducted on the

usefulness and sustainability of these remote e-mail stations show a steady growth in usage and revenue.[3] Studies show an increasing demand and adoption by the rural islanders for this type of access to ICT resources.

From June to October 2002, PFNet piloted a distance learning project at one of the remote e-mail stations. The Rural Development Volunteers Association (RDVA) in conjunction with the USP Centre in Honiara implemented the project to train a small group to use distance learning and to evaluate the success and scope for distance education efforts in the future. The Sasamungga Community High School site was equipped with two laptops to conduct this trial. Nineteen students were trained in using the computers for basic productivity skills and for online communication purposes. RDVA assisted with training and supervision at the site and collected data on the project's effectiveness.

E-mail was the primary means of communication, allowing students to interact with tutors immediately rather than through the unreliable mail system. Students submitted assignments and sought assistance from tutors via e-mail and used Wavemail (an e-mail–based interface for searching for information on the World Wide Web) to conduct research. The overall results of the trial were positive, with students successfully completing their courses and feeling enabled to use computers for distance-based education. A detailed analysis of participants' experience can be found in "Applying Information and Communication Technology to Education in Rural Solomon Islands."[4]

A major goal of the project was to determine whether this model would indeed lead to better access to distance learning courses. The intention was to provide information that would allow the USP to develop courses designed towards delivery via e-mail. Researchers tracking the project to collect evaluation data on its effectiveness presented their results at a September 2003 National Education Conference. Overall, the project was judged successful and there are hopes of being able to broaden it to a national level if funding can be secured.

The third prong of PFNet is an Internet cafe based in Honiara. This cafe provides access to computers and the Internet as well as training classes for the general public (see below). Though the cafe generates a steady income, it is not yet self-sustaining, partly because of the high cost of overseas-sourced technical support. The operating costs are defrayed by donor funding, which has been inconsistent due to a lack of international confidence resulting from political instabilities in the nation.

Examples of training

Along with access to computers, the Internet cafe provides non-formal computer and Internet training courses to interested individuals and organizations. These classes are geared towards those who want to learn practical computer-skills and are open to people without previous computer experience. Classes include Introduction to Basic Computing, Introduction to Microsoft Word and E-mail and Internet Training.

Additionally, PFNet provides training to people in the rural areas where the e-mail stations are set up. Research studies have been conducted to see how these remote stations are used by communities. In a random sample of those surveyed, 64 per cent said someone in their families had used the station and 38 per cent had used the system themselves. Both men and women use the system, with the percentage breakdown being fairly balanced between genders in a society where women may traditionally have less access to these sorts of initiatives.

The ICT working group, formed as a result of the February 2003 ICT Strategy Building Workshop, has obtained funding for a Youth Focal Point and Computer Resource Center. Trainings at this centre will be targeted towards students who need access to computers and the Internet, especially those who need these resources to access tertiary education opportunities. The centre will provide affordable access and computing facilities where students can do research and complete assignments, learning computer and technology skills in the process.

Details on computer training for government ministry officials, RDVA volunteers, PFNet staff and rural operators of e-mail stations are available in a 2003 report.[5] Computer training was provided as appropriate on a range of skills from basic computer to e-mail usage to web page design and website maintenance.

Constraints on the use of ICT

The greatest challenges faced by the Solomon Islands are internal instability and unrest. The related economic crisis has left the islands in dire straits financially to proceed with development efforts in all sectors.

The lack of a national strategy is identified as one main challenge to the development of ICT in education. Without a national strategy for ICTs, the Solomon Islands have no means to systematically build the local capacity or human resources needed to lead, implement and support the growth of ICT. A vicious cycle of a lack of awareness of ICT in the development of the nation leads to a lack of policy and progress in this arena. In turn, this perpetuates a gap in understanding of how to create policies towards ICT infusion in educational curriculum at all levels.

Experts are disappointed that a recent draft of the National Economic Recovery and Development Plan (NERDP) does

not include a blueprint for a national information communication technology network. In a September 2003 interview for Radio Australia's *On Location Pacific* show, David Leeming, technical advisor to PFNet, discusses the need to see ICT more integrated in the existing draft of the NERDP, to make it a strong force in rural access and development.

Other constraints to setting up ICT are the isolated nature of villages scattered over large geographical distances. Much of the population is far from urban centres, where they might get access to and training on technologies. Utilities such as electricity and telephones are not to be taken for granted. In addition rural ICT requirements differ from urban ICT requirements. Providing and maintaining equipment to rural areas will require special attention.

Analysis

PFNet's extensive work, experience and evaluation of using ICT in rural areas for distance learning and practical training provide the best base on which to plan future ICT efforts in the Solomon Islands.

PFNet's reports on results of trials show an enthusiasm and desire on the part of participants in their various projects to use ICT to gain access to education and consequently to more opportunities. Distance education is both a practical and necessary means to build capacity in the Solomon Islands. Recent experience with PFNet's trial efforts shows that the outlook for using this means of education is positive and possible.

A study to keep track of in the upcoming year is the USP-led project that will conduct further in-depth research on the impact of the PFNet system. The project aims to study the existing five e-mail stations and identify the factors that affect the uptake of services and the appropriation of the system by the community. The result of the study is slated to be available in early 2004 and will likely inform future expansion of the ICT in rural areas of the Solomon Islands. This research and related developments will be key lessons to heed in extending ICT efforts for rural schools and for providing ICT training to school-aged youth in the Solomon Islands.

In September 2003, a workshop on distance education co-ordinated by a European Union consultant brought together all major stakeholders and funding sources that will have an impact on the development of ICT in education in the Solomon Islands. The aims of the workshop were to foster dialogue on distance education and develop co-ordination of distance learning initiatives for the nation. One recommendation of this workshop was the creation of the National Co-ordinating Committee for Distance Education to be established by the Ministry of Education.

While there are many challenges to creating a sustainable future for ICT in education in the Solomon Islands, there have been successes worth pursuing. ICT can support development efforts, providing income-generating opportunities to those who live in rural and poverty-stricken areas. The Solomon Islands will also benefit from building its local capacity and training youth to become future leaders and policy-makers in a globally connected marketplace.

Future efforts to develop ICT in education and training in the Solomon Islands will be well served by leveraging the lessons learned and consensus built by the ICT-related stakeholder groups already operating in the Solomon Islands. The PFNet and now the newly formed National Co-ordinating Committee for Distance Education are two important groups to collaborate with in bringing ICT into educational efforts for the Solomon Islands.

NOTES

1 E. Stork, D. Leeming and R. Biliki. "Electronic Journal on Information Systems in Developing Countries" (Solomon Islands ICT workshop report, 2003) 1-18.
2 D. Leeming, R. Biliki, M. Dennis et al. "Applying Information and Communication Technology to Education in Rural Solomon Islands" (2003), *www.peoplefirst.net.sb/downloads/SICHEPFnetSept03.zip.*
3 See note 2 above.
4 See note 2 above.
5 D. Leeming and R. Biliki, R. "People First Network, the Solomon Islands' Rural E-mail Network for Peace and Development: Final report" (2003), *www.undp.org.fj/documents/ICT4DEV/PFnet_Final_Report.pdf.*

Democratic Republic of

Timor - Leste

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

Timor-Leste is the newest nation of the 21st century, formed when its people voted overwhelmingly for independence from Indonesia in 1999. In the months that followed the independence vote, the Indonesian-backed militia that had occupied East Timor left the country, destroying 90 per cent of the existing infrastructure.

This state, borne in conflict and torn apart by violence, is in the nascent stages of rebuilding. Development of national policy and

reconstruction are happening in all public and private sectors with the aid of international organizations. The United Nations Transitional Administration in East Timor (UNTAET) has played a lead role in the development of national policy and governance since the birth of this nation. The year 2002 was an important one for the country, as it adopted its first constitution, elected its first president and made the transition from United Nations rule to complete independence.

ICT in Timor-Leste - still in its infancy as a self-governing nation – is reflective of the emergent steps being taken towards building capacity and infrastructure in all sectors. Currently, Timor-Leste is operating under a National Development Plan, which emphasises poverty reduction and economic growth as its top priorities. In a May 2002 meeting of the transitional government, international financial institutions, non-governmental organizations (NGOs) and UN agencies, a three-year budget framework that included a 48 per cent allocation of funds towards health and education was discussed.[1]

The first Ministry of Education was re-established by the transitional government in 2001. One noted achievement of this government was the return to school of 240,000 students and 6,000 teachers in October 2001, a process aided and administered by the United Nations. While no policy on information and communication technologies (ICTs) is addressed by publications and press releases regarding Timor-Leste's education sector, investment in technical and vocational education for older students is listed as a high priority. The Ministry for Transport, Telecommunications, and Public Works has an information technology division that is responsible for national policy on communication and technology. Efforts being made by this agency are detailed in the section "Major Initiatives."

Current level of ICT access and use

In the destruction that took place in 1999, public institutions such as schools, hospitals and offices were destroyed; 90 per cent of primary and secondary schools and the entire higher education system were demolished. Rebuilding schools has been a priority of the Ministry of Education since its inception in 2001.

There is very little proliferation of ICTs in K-12 education in Timor-Leste. With pressing challenges such as a lack of pencils and textbooks and a shortage of people qualified to teach, technology is not seen as a priority.

The US-based non-profit Fund for East Timor, an organization involved in the rebuilding of Timor- Leste, states that while the school system is being rebuilt and re-established as compulsory for all students through grade 9, nothing is established to provide student training in information technology. However, the desire appears to be there, as evidenced by a struggling technical school in Dili that teaches English and computer skills and has 3,000 applicants per quarter for 150 openings.[2] The organization identifies how vital it is for East Timorese youth to be trained in ICT to compete in the world market.

An existing satellite radio network provided by Equal Access, a US NGO, does reach districts around Timor-Leste at community centres established in the schools. At the time of writing, no information was available on what, if anything, this is being used for.

Local universities and colleges in Timor-Leste provide a glimmer of ICT infrastructure and training in higher education. Details on these educational initiatives are outlined below.

Major initiatives

Government-related Initiatives

The Ministry for Transport, Telecommunications, and Public Works is spearheading the efforts to have ICT reach the people. Efforts are being made to set up a nationwide telecommunication infrastructure in the 13 districts that make up Timor-Leste. The website for the ministry describes the plans for setting up this satellite-based telecommunication infrastructure, noting that its main goal is to link schools and hospitals to the Internet to provide telemedicine and distance learning opportunities. Their website also mentions plans for an Internet Academy intended to train people in using such resources.

University-level initiatives

The National University of Timor Lorosa'e (UNTL) opened for classes in November 2000. When the university first opened "there was no accessible library, no administrative infrastructure, no phone network, no IT system, no Internet, no photocopiers, no fax machines, no audiovisual equipment or other basic teaching equipment; each faculty shared a bare classroom with a few old tables and chairs and a single secondhand computer."[3]

The university has plans to set up a computer lab with Internet access, so that students can learn some rudimentary computing skills that will help them get jobs and aid them in their research. Currently, UNTL does not offer coursework in the information technology field, but in their long-range plans they plan to offer media and communications courses.

UNTL is also building the nation's first library. The university and its library are seen as vital to the reconstruction of Timor-Leste, providing training to the nation's future teachers, public servants and leaders. The library houses 35 computers, two servers and other information technology equipment. Its one

uninterrupted power supply is inadequate to protect the equipment from power surges and electrical failures; thus, the UNTL is soliciting donations for various hardware and software. They are also seeking help from qualified ICT staff who may be willing to train local staff to maintain and manage the network.[4]

NGOs and Other Aid Organizations

Several international organizations are working on education efforts and partnering with local agencies in Timor-Leste, including UNTAET, the United Nations Children's Fund (UNICEF), Asia Pacific Development Information Programme (APDIP) and the previously mentioned Fund for Timor-Leste. UNICEF is looking at gender equity issues in addressing girls' education, trying to ensure that curriculum does not relegate girls to only have access to predetermined roles. APDIP and UNTAET are working with government ministries to set up educational infrastructures that include planning for ICTs.

The Fund for East Timor is exploring the most effective ways to create a core of experts who will be able to guide the efforts toward ICTs in education. The hope is that this core group will train others, see to the wiring of the schools and assist in the other ICT needs of the country.

Examples of training

Along with the UNTL, several international aid organizations, NGOs and universities are playing a role in training and developing Timor-Leste's teacher capacity and education system. Some of these initiatives include ICT facilities and intentions of building capacity in this area.

- ***Teachers College in Baucau.*** A Catholic teachers college in Baucau has been in formation since late 2000. This college is an initiative of the Marist Brothers in Australia. Australian Catholic University (ACU) is a part of this project, providing staff to assist in the development of the college and in onsite training. The teachers college houses a trilingual library and computer centre.

  A teacher trainer from ACU describes her experience working with teachers in each district to provide classes and work with local committees associated with the opening of the college. She describes the difficulties of reaching teachers in remote schools, the legwork necessary to bring teachers together (without the benefit of telephone and fax to reach them at their schools) and the adjustments she learned to make when she realised the irrelevance of some of her assumptions about teaching in this new cultural context. She concludes that there is definite enthusiasm amongst teachers to learn things that they may not immediately use, but that they may use in the future. For instance, along with teaching and classroom management skills, teachers requested lessons in computing skills.[5]

- ***Swineburne University of Technology.*** In 2002, a group from Swineburne University of Technology in Victoria travelled to East Timor to find out how to set up a communication project geared towards providing Internet access for students with the support of rotary organizations in Australia.[6]

  The group visited the teachers college in Baucau to get an understanding of the existing scenario. According to Amiguet, "the project may be delayed until communications in the country are properly established." While no follow-up information was available on the web about the progress of this effort, one person in the group planned to return to Timor-Leste to train nuns at the Catholic school to use computers so they could in turn teach students.

- ***Technical Colleges.*** According to the UNTAET Press Office, more than 700 primary schools, 100 junior secondary schools, 40 preschools and 10 technical colleges are currently functioning in Timor-Leste. [8] If the technical school in Dili that has 20 times as many applicants as it can accept is indicative of the country's interest in information technology, it seems these technical colleges are logical places to place ICT efforts geared towards training secondary-level students.

Constraints on the use of ICT

There are four categories to the constraints on the use of ICT in Timor-Leste: resource allocation issues, infrastructure issues, human resource issues and language issues.

The most obvious challenge of using ICT in Timor-Leste is that of resource allocation. In this poverty-stricken developing nation, just beginning to rebuild and recreate itself from the recent decimation that took place, the government's main focus is on addressing basic needs. Funding provided by international organizations and donors is most often focused on essential services and basic needs.

The ravaged infrastructure is the second issue. As in many developing nations, utilities cannot be taken for granted. The electric power system is unreliable and has caused many donated computers to break down, and few people know how to repair them.[9]

Another challenge is the difficulty of finding qualified teachers who can learn how to use ICT resources and infuse

them into education. Many teachers are under-qualified and not formally educated. The pressing need is to train teachers in basic teaching strategies and content. The difficulty is that teaching is not viewed as an honourable or lucrative career in Timor-Leste. People who do complete a high school education, and even those who attend college, do so only to find jobs abroad. The lack of a trained workforce in education adds challenges to training and retaining those who would have the language skills, technical skills, motivation and ability to use and integrate ICTs into education.

Finally, the existence of multiple languages creates challenges in teacher training efforts and materials development. Timor-Leste's national language, Tetum, has three different forms. Additionally, there are 17 indigenous languages and Portuguese is re-emerging after 25 years. UNICEF is advocating for local language instruction with the introduction of Portuguese and English as foreign languages later in a student's education.

Analysis

In reports on Timor-Leste and in narratives written by aid workers and volunteers who have travelled there, a common thread emerges: the East Timorese place much value on education and the enthusiasm of teachers to obtain training.

A visiting faculty member who spent a semester teaching at the teachers college in Baucau states, "Some [Timor-Leste teachers] have worked for many years in schools with hardly any training at all. But they have plenty of enthusiasm for learning and improving the quality of education in their newly restored country."[10] Another visiting teacher trainer writes of the engagement and enthusiasm of teachers who came to his workshops on science and math strategies, eager to absorb whatever information they could get. These anecdotes indicate that teachers will likely be eager to learn and use ICT resources, given the opportunity.

Some recommendations follow on where ICT development efforts in East Timor may be well placed.

- **Reaching teachers through existing centres of learning:** A logical place to focus ICT efforts is the centres where teachers are trained, such as the National University and the teachers' college. These places are a nexus – where funding, services, and infrastructure are currently more available or part of long-range plans. Bolstering existing infrastructure and providing training for staff who will in turn support educators will lend itself to more sustainability than diffuse efforts that are harder to follow up and support.

- **Training technical staff in key locations:** The UNTL Library Project identifies the need for training ICT staff to maintain and manage a network, establish a multimedia centre and train other local staff to create a sustainable network.[11] Its website is definitive on what skills and supports are needed to develop local ICT capacity.

- **Needs assessment on most useful areas for ICT in training:** A needs assessment on the key areas that educators could use ICTs in their skills development would inform planning. For example, teachers are apparently eager to develop English language skills in hopes of increasing their access to further education either at the university in Dili or at the teachers' college. Technology and telecommunication can be vehicles to provide these sorts of training, using interactive multimedia and distance learning resources/courses (when the communication and computing infrastructures allow).

- **Reaching East Timorese youth:** Schools in Timor-Leste seem to face many challenges, and introducing computers into schools will be a difficult task given the current realities. Providing exposure and access to computers for Timor-Leste's youth today will require creative strategies that extend beyond the school. Programmes that give students the opportunity to learn and use computing resources should not place the burden of maintenance and training on already overextended teachers who do not themselves have the adequate resources or training to properly introduce students to computing. After-school or community-based programmes using mobile labs and trained staff dedicated to the project may be a first step in exposing Timor-Leste's youth to the computing resources that they will one day be expected to use proficiently as part of their citizenship in the global society.

NOTES

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Tonga

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Situated north of New Zealand, Tonga comprises about 150 islands with a land area of 748 square kilometres. Only 36 of the islands are inhabited. The main islands are Tongatapu (location of the capital Nukualofa, seat of Parliament and main commercial centre), Vava'u, Haapai and Eua. The population of 102,321 (2002) speak Tongan and English. Politically the country is a monarchy with a Parliament that comprises nobles and representatives of the people. The currency unit is the Tonga Paanga.

Tonga has over 100 primary and secondary schools that provide compulsory education between the ages of 6 and14 years. Tertiary institutions include the Teachers' College, the University of the South Pacific (USP) Centre and Atenisi University. The Community Training Centre provides community vocational training programmes. Tonga is a member of the regional USP, and hence it is part of the privately owned satellite system called USPNet.

National policies, strategies and programmes

There does not seem to be an information and communication technology (ICT) policy in place, either for national purposes or for education, even though Tonga is a member of the Pacific Islands ICT Policy and Strategic Plan (PIIPS) accord signed by the ICT ministers of the region recently. However, there have been discussions on this issue between the Ministry of Education and the Central Planning Department. Under the Tonga Government Strategic Development Plan 2001–2004, the following ICT items relate to education:

- Development of ICT curriculum for secondary and tertiary education levels – a planned pilot ICT project at the primary level was not implemented due to a lack of funding;
- Computer training programmes – planned but not implemented due to lack of funding; and
- ICT strategic plan – implementation being undertaken with AusAID funding.

Current level of ICT access and use

Telecom Infrastructure and Connectivity

There are two telecommunication organizations in Tonga: Tonga Communications Corporation (TCC) and Shoreline Communications (Tonfon).

TCC consists of two components: terrestrial lines (copper) and wireless (U-call mobile). The copper wires cover Tongatapu and some parts of Vava'u, Ha'apai and 'Eua. U-call covers the whole of Tonga, mainly Tongatapu, Vava'u, Ha'apai and 'Eua. U-Call had about 4,000 subscribers in April 2003.

The local Internet service provider (ISP) is under TCC and at one stage was a monopoly (Kalianet). It covers mainly Tongatapu with a dial-up subscriber base of around 1,500 at present. The ratio of the number of dial-ups per modem is around 16:1.

Tonfon is a mobile service that competes with U-call. It has over 10,000 subscribers.

Internet Access

There are other Internet cafe services available in Nuku'alofa now, due to the cheap rates offered by TCC. However, local telephone call charges still apply. Tonfon competes for the service to businesses but is not competitive in the home market. The Internet cafes offer access at different rates depending on the ISP used. A few of the computer/office equipment suppliers/distributors also provide Internet access to the public at competitive charges.

Most of the high schools have Internet access for students and are connected via dial-up. One high school has a dedicated line to its Internet connection. Only one primary school is connected.

At the tertiary level, the USP Tonga Centre, which is part of the USPNet satellite network, is linked to other USP member countries. Through this link the distance and flexible learning programme of the university enables students to access courses by video broadcast and Internet, as well as being supported through audio conferencing and video conferencing sessions that use WebCT. Some of the programmes taught through USPNet are at the vocational level.

Many people, particularly expatriates, use privately owned satellite dishes to receive television signals.

Broadcast Technologies

Radio is probably the technology that has the most ubiquitous effect in the community as a whole. Nearly every household has a radio, and those that do not listen to the neighbour's. There are school programmes (at the primary level) that reach the rural areas. Target groups range from primary schools to churches, women's development groups, sports groups and some disadvantaged groups. However, these latter programmes (except the primary school programmes) are mostly non-formal.

Television is less available. There are three stations, Tonga TV, OBN and Tonfon TV (a religious station). In addition, Mormon churches receive satellite TV in their church centres throughout Tonga. There are no educational programmes broadcast via TV, as yet. However, t he UNITEC Royal Tonga Institute, scheduled to open in February 2004 as an affiliate of UNITEC Auckland, plans to broadcast tertiary education programmes via TV next year. (UNITEC is a tertiary institution in Auckland, New Zealand, that offers certificates, diplomas and degrees.)

Table 1: Internet access and use in education

	Primary	Secondary	Vocational	Teachers' College
Access	Very limited	Most schools have ICT access but to what extent needs further investigation	• Government-owned Community Development Centre has access • Tupou High School (THS) has a diploma programme in affiliation with a New Zealand tertiary education provider	Poor – no computer lab
Usage	Very limited	Most schools use ICT but the extent needs further investigation	• Usage is very limited at both THS and Community Development Centre	Usage is limited – probably due to lack of ICT training

Major initiatives

A major success is the founding of the National ICT Society (NICTS) – the first and only independent non-government ICT body in the Kingdom. NICTS has just received its certificate of registration with the Ministry of Labour, Commerce and Industries, as a non-governmental organization (NGO). This enables it to become operational along the lines of its constitution and should therefore be able to offer its services for the improvement of the ICT situation in the country.

NICTS aims to improve the use of ICT in education by brokering partnerships with government in terms of aligning ICT curriculum with local ICT needs and international trends, and by brokering partnerships with teachers so that they share their experience and resources and use the NICTS as a hub for accessing ICT resources they do not have. In fact, this project is being looked at and there are talks of forming a teachers' ICT association (perhaps under NICTS).

Currently, NICTS is seeking funding for conducting studies of ICT training gaps. One of NICTS projects for 2004 is the development of ICT resources based on the studies conducted. Also, NICTS plans to have participative partnerships with private businesses to provide employment through meeting local ICT requirements. In turn, NICTS intends to liaise with the Education Department and promote the alignment of current ICT curriculum with those needs.

It is also planned that NICTS will train people in the villages on how to run a telecentre and the technical side of maintaining computers and other electronic equipment. They would also get training in web surfing, e-mail, MS Word, Excel, etc., so they can teach villagers and help students in the village with their homework.

Other initiatives include the following:

- Radio is being used for non-formal educational programmes particularly in rural areas.
- Central Planning Department is pushing for Computer Science to be a compulsory subject in the national secondary school syllabus.
- In the past three years, the Peace Corps has established telecentres in Tongatapu and Vava'u, but sustainability is a major problem.
- The Tonga Royal School of Science is operating in its new location at the Touliki navy base. This provides Internet access as well as access to PCs for general use. Because of its distance from the vicinity of the town centre, the main users of that service are people in the military.

Examples of training

- ICT training on software usage is provided at Tupou High School. This involves para-professional training in computing (database, spreadsheet, information systems – software and web development).
- At the USP Centre, there are short courses (12-week duration) on Microsoft application packages.
- Teachers' College provides training for teachers to teach ICT at the secondary level.
- ICT in Teachers' College was only introduced in 2002. According to one ICT teacher there, the major constraint is the lack of facilities as there is no computer lab in place. There is also a great need for training. Despite these limitations, teachers have begun to teach ICT at form 4 and above.

Constraints on the use of ICT

- Policy-makers are not ICT experts and lack the knowledge and insights on ICT matters that should be considered in shaping ICT policy.
- The cost of access impedes ICT development.
- The lack of training is a further constraint, as are the unco-ordinated efforts of providers.
- Access to and usage of ICT in rural areas is low as indicated in the low usage of Peace Corps telecentres.
- There is a lack of information about the state of ICT access and usage not only in education but also at national level.

Analysis

Access and affordability on Tongatapu appears to be partly addressed by the ISPs now operating. However, in the schools, there appears to be a need to provide a guiding policy, and with that, an ICT curriculum for teaching throughout the different levels of education.

The cost of hardware in the first instance remains an inhibiting factor – thus the initiative of telecentres seems to be a positive move. The placing of some equipment in one location for the access of village dwellers will provide access. However, perhaps the low usage is due to the lack of skills so some training is certainly needed and NICTS seems to be moving along these lines.

With the establishment of the NICTS, there seems to be a conscious effort to address the ICT situation in Tonga. The lack of national and educational policies seems to be a drawback that the NICTS plans to address.

Tuvalu

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Tuvalu comprises nine coral atolls with a land area of 26 square kilometres. The islands are spread over 1.3 million square kilometres of sea. The population of 10,838 (2002 figure, growth rate of 1.41 per cent) is Polynesian, and largely bilingual (Tuvaluan and English).

Eight of the nine atolls are inhabited. The main atoll is Funafuti where Parliament sits, and which has the government department headquarters, the main primary school, the one hotel, the only

airstrip and the main commercial centre that comprises the bank, the co-operative wholesale society shop and a few other shops. The other major island is Vaitupu where the major secondary school, Motufoua, is located. The other secondary school, Fetuvalu, is owned by the Tuvalu church and located on Funafuti. There are 10 primary schools, two on Funafuti (one of which is operated by the Seventh Day Adventist church) and one on each of the other islands.

Tuvalu is an independent state and a member of the Commonwealth. The Tuvalu economy is based on licensing of fishing vessels, remittance from Tuvaluans living overseas and, recently, the selling of the domain name ".tv" to a US-based company. The currency used is the Australian dollar. Tuvalu is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

The Tuvalu National information and communication technology (ICT) policy is in draft form. Negotiations with stakeholders are still underway. It is anticipated that when sufficient information has been collected, endorsement of the policy will be sought with implementation expected by 2004. The Tuvalu Policy Vision is "Information and Communication Technologies for every Tuvaluan Citizen." It follows the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan – a regional ICT strategy agreed and signed by the Communication Ministers of each respective Forum country member. For Tuvalu, these principles are:

- ICT will be used to inform and connect Tuvalu citizens and ensure that they benefit from flexible and appropriate education and training.
- Appropriate ICT infrastructure will support development for Tuvalu Islands.
- Easy access to information through ICT will strengthen co-operation between stakeholders to ensure good governance, to develop the private sector and to improve service delivery.
- ICT policies and regulations will be appropriate to the people and culture of Tuvalu.

Strategies to implement the aspects of the ICT policy which are relevant to education include promoting greater awareness of ICT, developing and retaining a knowledgeable workforce in ICT, developing and maintaining training policies and programmes to ensure ICT resources are properly managed, providing equal access to ICT, developing ICT infrastructure to promote universal access, addressing affordability of ICT technology and continually evaluating ICT plans and its impacts. Table 1 shows specific strategic plans relevant to education.

Other planned strategies include consultation with a wide range of stakeholders, developing exchange and vocational programmes by the education sector, incorporating gender issues and developing community awareness programmes to maximise benefits and minimise adverse social impacts. There are also plans to review communication tariff regulations to maximise benefits to communities.

Current level of ICT access and use

Connectivity, Telephones, Facsimile

The Tuvalu telephone infrastructure at the moment is a cable network. Subscribers with Internet accounts dial in for connection. Since there is a limited number of 32 lines available for home Internet connection, this system operates on a first-come, first-served basis. This is insufficient and thus most people go back to their offices after working hours to surf the Internet.

Table 1: ICT plans for education

Activities	Identifiable actors	Deadline
Build ICT into school curricula at all levels	Education Ministry	2004
Train teachers/trainers	Institutions	2003
Install ICT in schools	Education Ministry	2003
Create Internet cafés	Government and business	2003

Fax communication is available and very efficient for overseas services. However, within Tuvalu, there is a lengthy wait for connections to the outer islands because of the limited number of available lines (two to four per island). Vaitupu has the most lines available, but even these are not sufficient to meet the needs of the public.

Computer Use, Internet/World Wide Web for Education, E-mail

Except for the USP Tuvalu Centre, all schools at all levels have only a couple of computers for teachers to use in preparing their teaching materials. The Internet is available in Funafuti, but the two primary schools there have no access due to the high connecting fees. Most children have been exposed to computers and the Internet, but there are no facilities for hands-on experience on a daily basis. However, there is a general understanding that UNESCO will provide assistance to help connect schools throughout the country. USP students in Funafuti have access to e-mail and Internet facilities through USPNet.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students in Funafuti only. Students who are enrolled in the distance and flexible learning courses of the university are able to take advantage of the USPNet system for communications with their lecturers and other students. Video broadcast courses enable Funafuti students to join in the lectures that are being delivered on Laucala campus. Tapes of video broadcast sessions and audio conference tutorials are available for Funafuti and outer island students on request to the Suva headquarters of the university.

Broadcast Technologies

Radio is the only broadcast technology in the country and there is only one educational programme that is aired once a week. This is mainly a lesson taken at the biggest primary school in Tuvalu (the Nauti Primary School on Funafuti), recorded and aired over Radio Tuvalu at the mentioned time.

There is also an awareness programme on the courses offered at the USP Centre that airs fortnightly.

Major initiatives

The main initiative is USPNet, the partnership between USP and Tuvalu through the exemption made by the telecommunication organization to allow the system to operate privately. This 12-country satellite system has made it possible for Tuvalu students to complete programmes while continuing to work and without leaving their families. The multimodal facility of the network provides different modes of learning experiences for the students including video conference tutorials and audio tutorials with the lecturer in Fiji or Vanuatu. There are also online courses from the Law programme which is based in Port Vila, Vanuatu. The next phase for Tuvalu is to make the technology work in the outer islands so that the USP students there will benefit from the same experience as the students in Funafuti.

Other initiatives include a survey of stakeholders by the government in 2001–2002 conducted to obtain information on public awareness and usage of computers and the Internet. Responses to the questionnaire were analysed and resulted in the formulation of the strategic plans outlined above.

In 2002, the IT Department set up two PCs with Internet access in their office for the public to use for a small fee. Government civil servants also use these since not all of them have access to the Internet in their own offices. As well, the IT Department has established an online information site for Tuvalu updates. Tuvalu citizens overseas have commended this initiative (see *www.tuvalu.tv*).

Examples of training

An ICT Expo Week was organised for the general public but attendance was not as high as anticipated. Again, being understaffed, the IT Department was unable to fulfil the objectives. At the moment, there are only two qualified ICT staff assisted by an expatriate expert and a local trainee. The department also conducts basic training programmes but their work revolves around installing and maintaining computers, faxes and printers.

The USP Centre offers courses on computing, which is another, albeit limited, avenue for training.

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in education in Tuvalu:

- Limited human resources with ICT qualifications and limited training opportunities;
- ICT qualified Tuvaluans emigrate overseas due to the lack of incentives in their work environments;
- Lack of government funding and other support to develop ICT and broadcast technologies;
- Limited institutional ICT capacity;

- High costs of information management systems;
- Expensive ICT equipment and services in Tuvalu;
- Isolation and remoteness of the islands; and
- Understaffed IT Department.

Analysis

Only government departments and corporations on Funafuti have access to ICT services. The outer islands as well as the private sector cannot afford the expensive Internet connection fees. Even most government ministries utilise only one or two accounts for Internet access.

In education, the low level of access is a great concern. For a country that is spread over a large expanse of water, communication through modern technology must be a priority in order for the population to access information on the Internet.

It is apparent, also, that there is an urgent need for adequately trained and more experienced personnel, as well as for financial assistance in the form of facilities and equipment. There are high expectations, therefore, that UNESCO will assist in improving access; this must occur if the country is to benefit from ICT.

Given the scattered nature of the atolls, educational radio broadcasting from Funafuti could be explored further.

Vanuatu

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Vanuatu lies northeast of Sydney, Australia, and was known as New Hebrides until 1980 when it gained independence from France and Britain. It consists of a Y-shaped chain of some 80 islands spread over 848,000 square kilometres of sea and a total land area of 12,190 square kilometres. There are active volcanoes on Tanna, Ambrym, Lopevi, and Gaua. The indigenous people are known as ni-Vanuatu.

The total population of close to 200,000 (2003 estimate) speaks Bislama (the national language), as well as English and French

which are the official languages and also the languages of formal education. Vanuatu has around 113 indigenous vernacular languages in current usage and the government recently introduced a policy to teach the early stages of basic education in vernaculars, especially in rural Vanuatu.

The main island is Efate where the administrative centre Port Vila is located. Other large islands with population concentrations are Santo (the largest), Malekula (second largest), Tanna, Pentecost, Erromango and Ambrym. The country produces copra, fish, beef, cocoa, coffee, kava, timber and other wood products, and a limited number of manufactured goods. Tourism is a vibrant industry. However the subsistence sector continues to play an important role in the overall mechanics of the economy. The national currency is the Vatu.

Vanuatu is one of 12 member countries of the University of the South Pacific (USP), and therefore has access to the facilities of that institution including the USP Centre on the Emalus campus in Port Vila, Efate, and through it to the USPNet satellite system.

National policies, strategies and programmes

The 1999 Education Master Plan identifies, in broad terms, the need to integrate technology education with general secondary education. It further stipulates as Action 3 in Annex 3 the following:

> The government will introduce a comprehensive technology education programme in years 9 to 12 (grade 3 to 6) of general education. The technology programme should be holistic in its consideration of materials, processes and systems applied to technologies such as food, graphics, design, information and communications.

Furthermore, the plan makes reference to some previous expert consultations with New Zealand, and also to the possibility of seeking funding assistance for further information and communication technology (ICT) developments as follows:

> Because of New Zealand's experience with technology programmes in its general education system and its earlier involvement in technology issues in Vanuatu, the government will approach NZ to determine its interest in the programme.

It is nonetheless also generally acknowledged that other partners, including the European Union (EU), support the idea of assisting the introduction and use of ICT in the education sector. This is demonstrated by a recent study funded by the EU to develop an "Education: Information and Communication Technology Strategy Plan" (May 2003).

Up to March 2002 there was no clear national ICT policy, but there was legislation that covers access rights, copyright and ICT misuse. However, there was no centralised budget for ICT, and, according to a statement from the Vanuatu Broadcasting and Television Corporation (VBTC), the government is not promoting e-governance. Nevertheless, the government's Telecom development plans aim to "increase customer access and [the] number of customers." However, here too VBTC is skeptical stating that "the government is not organised at a fiscal level to produce a development plan for Internet services. Things may not develop in the next two years."

There is, however, some activity in government that includes building up computerised services, digitising government documents, providing subsidies for computer purchases, training government officials in ICT and reinforcing ICT training in schools, training institutes and universities.[1,2.]

Current level of ICT access and use

The infrastructure in place supports telephone, facsimile, Internet access, e-mail and data transmission services. Telecom Vanuatu Ltd (TVL) (see *www.tvl.net.vu*), a private sector monopoly, had 4,500 customers in 2002 and 1,020 Internet customers. But with increased awareness of the need for technology for business and education, these customer numbers more than doubled in 2003.[3] TVL, jointly owned by government, Cable and Wireless, and France Cables et Radio, provides some regulatory services. It has excellent infrastructure, extensive use of solar power and provides very good and affordable Internet connectivity.[4] With its effective rural telecommunication development programme, TVL has so far equipped most major islands of Vanuatu with telephone facilities.

Wireless (mobile) telephony was introduced in 2002 and demand for it is expanding in urban Port-Vila and Luganville. It will soon extend to other outer island centres. The rural electrification programme of the French-owned private company, UNELCO, also plays a catalytic role in stimulating the expansion of telecommunication infrastructure and, hence, the ICT development.

Vanuatu has 405 primary schools, 65 secondary schools and a handful of tertiary institutions that include the Teachers' College, the Vanuatu Institute of Technology (VIT), the School of Nursing, the Maritime College and USP. A new College of Agriculture is currently being built on Santo, funded by the Peoples' Republic of China.

In 2002, between 25 per cent and 50 per cent of the population had access to the Internet at home or through telecentres, while more than 75 per cent had access through workplaces, Internet cafes and government institutions. However, access through schools and public libraries is

much lower. Again through its education-friendly programme, TVL is offering the "Lagoon School" Internet package to schools that request it. Internet access is free during specified official working hours where it is available.[5]

Primary Education

The major population centres of Port Vila in Efate island, Luganville on Espiritu Santos, Isangel on Tanna, Lakatoro on Malekula, and Longana on Ambae, have some computers available for administration. Primary schools are slowly introducing computers at the initiative of their school committees, as the meagre funding allows.

Secondary Education

To date, all government-owned and some other secondary schools have computer laboratories, and most schools (both primary and secondary) use ICT facilities for administration.

Post-secondary Education

The USPNet. A satellite service for distance education is provided through USP for students studying there. The university's Emalus campus in Port Vila comprises the USP Centre in Vanuatu, the School of Law, and the Pacific Languages Unit. University degree, diploma and vocational programmes, through both distance education and onsite courses, are available to all eligible students throughout Vanuatu. Distance education students have access to the tele-instruction in Port Vila and it is anticipated that the same facilities will be provided to the two subcentres in Luganville, Santo, and on Tanna, with instruction through USPNet (the communications network of the university). This will effectively enable Vanuatu students to complete a large proportion of the courses for the university programmes without having to attend classes on other campuses. Negotiations between the university and TVL are underway to enable this extension of USPNet to Santo and Tanna.

Meteo ICT project. A project is currently being developed for funding by the US authorities through the meteorology office to provide Internet facilities through schools and communities, with the aim of assisting the latter to monitor the weather and meteorological conditions, and to provide preparedness measures in times of natural disasters.

Police Crime and Disaster Management Project. A similar proposal, manned by the police authorities and designed to help maintain law and order, is in place in communities in provincial areas with access to schools, which assist with monitoring activities.

Broadcast technologies. Radio and television are widely used in Vanuatu, but there is currently very little in terms of distance education using these modes. This is an area needing further study and assistance for effective use of these technologies for education.

Major initiatives

One major initiative was the World Health Organization (WHO) project on training health workers. This involved establishing a computer lab to train medical personnel, beginning with distance learning for nurses. Completed in October 2003, the lab has 10 state-of-the art PCs, a server, web filter, and printer. Two training workshops have been built in as part of the project, the first one covering the basics of Windows XP and the second covering intermediate applications.

Other initiatives include the following:

- Satellite links through the USPNet;
- Internet cafe available in Vila, and Luganville (Santo); and
- USP Centre with its own computer labs in Vila and Luganville with Internet access. (A new lab is being developed on Tanna in collaboration with the TAFEA provincial government council.)

Examples of training

- Telecom staff have received basic, intermediate and advanced computer training while VBTC staff have attended journalism training workshops.
- The USP Centre has provided continuing education computer courses for the public at large. The courses offered range from basic computer awareness to the use of e-mail and Internet, PowerPoint and Publisher. More advanced professional training for programmers and systems administrators was also offered last year.
- The VIT also provides computer courses to the public as part of its adult education programme.

Constraints on the use of ICT

The following constraints were identified at the start of 2002:[6]

- Lack of locally qualified technicians and systems administrators;
- Limited technical support;

- Cost of equipment;
- Unreliability of power supply, poor quality of Internet connections, high cost of telecommunications, internally and externally;
- Lack of access to telephone networks;
- Lack of skilled support services;
- Limited bandwidth; and
- High access charges.

Analysis

Priority areas for Vanuatu have been identified as capacity-building in distance education, strategic planning for ICT in government and government-wide applications training in ICT.[7] A comprehensive training programme for local experts and technicians would be helpful, as well as assistance in the following areas:

- Community radio systems for basic skills and education for remote villages;
- Technical support for the government broadcasting system;
- Standardised technical training for government staff in applications and systems; and
- Capacity-building in distance education for the Ministry of Education.

NOTES

1 "Internet Infrastructure and e-Governance in Pacific Islands Countries" (UNESCO, March 2002), Appendix 15. This information was obtained from a survey of the VBTC, Telecom Vanuatu Ltd, and the Ministry of Lands and Natural Resources.
2 See the Asian Development Bank report TA REG 5990 "Information and Communication Technology in the Pacific", June 2002.
3 See note 1 above.
4 See note 2 above.
5 See note 1 above.
6 See note 1 above.
7 See note 1 above.