Evaluation OF COMPUTER SCIENCE C U R R I C U L U M IN FIJI SECONDARY SCHOOLS

ESTHER WILLIAMS, MAKI KATO & NATASHA KHAN

ICT Capacity Building at USP Project

2004

USP Library Cataloguing-in-Publication Data

Williams, Esther Wininamaori Batiri.
Evaluation of computer science curriculum in Fiji secondary schools / by Esther B. Williams, Maki Kato, Natasha Khan. – Suva, Fiji : ICT Capacity Building at USP Project, The University of the South Pacific, 2004.

101p. : ill. ; 30 cm.

ISBN 982-01-0567-6

1. Computer science—Study and teaching (Secondary)—Fiji—Evaluation 2. High schools—Curricula—Fiji I. Kato, Maki II. Khan, Natasha III. The University of the South Pacific. ICT Capacity Building at USP Project III. Title.

QA75.27.W55 2004 004..071099611

CONTENTS

MEET THE AUTHORS

Esther Batiri Williams was born in Fiji. She received her BA and MA degrees from Victoria University, Wellington, New Zealand and her Ph.D (Government) from the University of Queensland in Brisbane, Australia. She has worked for the University of the South Pacific for many years and has served in a number of positions including University Librarian, A/Director of Planning and Development, and Pro Vice-Chancellor. She has also worked in a number of regional outposts and has been attached for varying periods in libraries and organizations in Australia, Japan, United States, United Kingdom and Canada. In 2000, she spent one semester teaching at the International Women's University, University of Hamburg, Germany. Her work in libraries and information deals largely with ICT and she has recently been involved in research projects that include access to ICT by women for distance and flexible learning, ICT and challenges of information access in the Pacific, ICT and small and micro enterprises, and ICT and the curriculum. Esther is a keen sportsperson and has represented Fiji in squash in three South Pacific Games. She is a member of a number of committees including the PAN Asia ICT Research and Development Committee, ICT for Capacity Building at USP, Fiji Commerce Commission, and Fiji Audio Visual Commission.

Esther Williams

Maki Kato was born in Niigata, Japan. She received a BEd in Educational Psychology from Tohoku University in 1992. From 1992 to 1995 she worked for a Japanese software company as a computer system developer. From 1995 to 1998 she worked for the Botswana Government Computer Bureau as a Japan Overseas Cooperation Volunteer. During her time in Botswana, she enjoyed camping, going on safari, and barbecues. At the same time, she became interested in the role of ICT in education and development. After working in Botswana, she studied International Education and in 2000 obtained an MEd from the University of Massachusetts in the United States. Maki then joined Japan International Cooperation Agency as an Associate Expert and worked for the *ICT Capacity Building at USP Project*. Since May 2002, she has been in Suva, working for the Project as a coordinator and expert in the component "ICT Research and Training for Socio-economic Development".

Natasha Khan was born in Suva, Fiji. In 1996, she completed a BA in Sociology, Population Studies and Demography at the University of the South Pacific (USP) and was awarded the gold medal for Sociology. From 1997 to 1999, she was a Sociology and Population Studies tutor while assisting academics in these two departments in various social science researches. She joined the United Nations Fund for Population Activities (UNFPA) as a Project Officer in 2001 and joined the *ICT Capacity Building at USP Project* as a Research Assistant in 2002.

Natasha Khan

ACKNOWLEDGEMENTS

We wish to thank the many people who willingly took the time to meet with us, complete the questionnaires and share their knowledge, insights and opinions. We also thank the teachers, students and people in the IT industry who assisted the team.

Specifically, we would like to acknowledge:

- the Fiji Ministry of Education, particularly Mr Josefa Natau and Mr Viliame Dranivesi for providing us with baseline data and liaising with secondary schools so that we could conduct the interviews;
- all the secondary school students, teachers and participating agencies who were part of the study for completing the questionnaires, and attending the focus group interviews and the symposium;
- the field officers who conducted interviews under trying conditions;
- all USP colleagues, especially Mr Ron Keesing for the support he provided during the entire research period;
- the JICA Fiji office personnel for their support;
- Professor Fujinobu Takahashi for his sterling support, including technical advice and uplifting the staff morale, during the entire research period.
- Frances Pene, of the Institute of Education, USP, for editorial work and type-setting.

ABBREVIATIONS

AusAID	Australian Assistance for International Development
CDU	Curriculum Development Unit
CQU	Central Queensland University
CROP	Council of Regional Organizations in the Pacific
CS	Computer Science
FNTC	Fiji National Training Council
FIT	Fiji Institute of Technology
GoF	Government of Fiji
ICT	Information and Communications Technologies
ISP	Internet Service Provider
IS	Information Systems
IT	Information Technology
ITC	Information, Technology and Computing Services Section in the Fiji Government
JICA	Japan International Cooperation Agency
LTC	Lautoka Teachers' College
MOE	Ministry of Education
NCES	National Center for Education Statistics
TCS	Temporary Civil Service teachers
TPAF	Training and Productivity Authority of Fiji
TVET	Technical Vocational Education Training Section in the Ministry of Education (this is the section in charge of CS/IT Education).
UN	United Nations
USP	The University of the South Pacific

Terminology:
In the 1996 Fiji Computer Science Curriculum Prescription, the term CS is commonly used. However, the TVET Section is planning to use IT in the near future. Therefore, in this report we will use CS/IT where it refers to the present curriculum and IT where it refers to the revised curriculum.

INTRODUCTION

This report represents the findings of the research project "Evaluation of the Computer Science Curriculum in Fiji Secondary Schools" by the Information and Communications Technologies (ICT) Capacity Building at the University of the South Pacific (USP) Project under Japan International Cooperation Agency (JICA) funding. This is the first piece of research conducted under the ICT Research component of the Project.

The curriculum for computer science for secondary schools in Fiji was initially developed in 1993 and implemented as a pilot program in ten schools in 1996. Following the success of the pilot program, 74 schools implemented the curriculum in 2002 and in 2003 this increased to 86 schools.

Since its inception in 1996, the curriculum has not been reviewed, for political and financial reasons. Since 2000, when the Fiji Islands Education Commission Report/Panel[1] was published, some stakeholders expressed an interest in a review and were willing to contribute towards upgrading the standard of computer education to reflect their needs. They were also willing to provide computers and set up pilot programs. Due to time constraints and lack of resources, however, little was undertaken at that time.

The need to revise the present CS curriculum for Fiji schools arose out of a request from the Government of Fiji (GoF) to the USP's Vice Chancellor's Office. Prior to this request, the GoF, under the Terms of Reference of the Education Commission/Panel, requested the Commission/Panel to examine the ICT area in Fiji, both its role in education and the needs in the job market. In its Report, the Education Commission/Panel (2000) highlighted the desirability of offering courses in ICT in all schools in Fiji. It noted the rapid developments taking place in new technologies and forecast a high need for ICT in the future. It recognized that many operations, systems, and businesses in both government and private sectors would be moving towards the use of new technologies, and that it was time Fiji introduced CS and IT courses as compulsory subjects in schools.

In 2002, the research project was initiated. It had two main objectives:

1. to describe the current CS/IT education in secondary schools, and
2. to make recommendations to revise the CS/IT curriculum.

In this report, the term curriculum is used to encompass the prescription, its intention, implementation and attainment. The National Center for Education Statistics (NCES) Report [2] observes that curriculum is not content alone, but should be systematic in its approach regarding what it *intend*s to achieve, how it will be *implemented*, and what was *attained* in the end. This report hopes that such a holistic approach is also utilized by the Ministry of Education (MOE) when planning a revised curriculum, as this report goes beyond prescription revision.

The team of three researchers from the USP conducted the research from December 2002 to July 2003. The team was able to interview students, staff, stakeholders and individuals who had special interests.

This research attempts to review Fiji's current CS/IT secondary school curriculum with a view to expanding it and making it more relevant and responsive to market and personal needs. The results of the research will be submitted to the Ministry of Education's National Curriculum Committee for review and further action, and will also be used to assist the University's computing science program, including the Bachelor of Education (Computing Science/IT) program.

1. The Report includes a chapter on the importance of IT in education and the need for an IT curriculum in schools.
2. U.S. Department of Education. National Center for Education Statistics. (2000). *Monitoring School Quality: An Indicators Report,* NCES 2001-030 by Daniel P. Mayer, John E. Mullens and Mary T. Moore. John Ralph, Project Officer. Washington, DC: 2000. Accessible online at http://nces.ed.gov/pubs2001/2001030.pdf

METHODOLOGY

A combination of quantitative and qualitative research methods were utilized to obtain realistic data. The primary method was collecting data from students and teachers from 82 schools and some agencies, using questionnaires. Baseline data were also obtained from the Ministry of Education's Statistics Department, the Bureau of Statistics and the USP database. The secondary method was focus group interviews of stakeholders, teachers and students, using semi-structured questions to obtain in-depth information. Two schools identified as 'best practice' were visited for in-depth interviews. As a participatory action method, a symposium and a peer review meeting were held to share the research results with some of the stakeholders, such as the MOE, some tertiary institutes and some non-government organizations, in order to allow these stakeholders to contribute to formulating recommendations to improve the current CS/IT curriculum.

The scope

A significant part of the research is dedicated to evaluating the present CS/IT curriculum:
identifying what needs to be changed;

- postulating the effectiveness of the curriculum in terms of students' proficiency in using computer applications and also limitations in both learning and teaching, particularly in schools without access to proper facilities;
- investigating what areas could be identified for training to upgrade teaching skills;
- identifying ways the stakeholders could contribute towards strengthening the delivery of CS/IT in schools; and
- identifying IT skill requirements of recent school-leavers from the agencies and suggesting revisions in the curriculum to match the needs of potential employers.

The design

The interview was the main research tool used and separate questionnaires were designed for each of the interviewed groups, namely agencies, students taking CS/IT as a subject and CS/IT teachers.

The student questionnaire had a total of 30 questions and 60 variables to be tested. The teachers' questionnaire had 47 questions and over 100 variables and the agency questionnaire had 17 questions and more than 35 variables. Please see Annex 11 for the questionnaires.

In the design of the questionnaires and conduct of interviews, a number of activities were undertaken. These are listed below in chronological order.

1. Obtained baseline information such as the names of schools offering CS/IT education from the MOE's TVET Section, which is the supporting section for CS teaching in Fiji secondary schools.
2. Reviewed similar research questionnaires used in surveys in the United States, Australia and New Zealand. Questions were formulated. These were reviewed by the research team and field-tested. The agency questionnaires were pilot-tested by a few agencies; the student and teachers questionnaires were tested by the field officers. The three questionnaires were revised and printed.
3. Conducted a small pilot in the Suva area. Faxed an announcement letter to all schools and agencies with an outline of the research, requesting their cooperation. For the agencies, the cover letter was addressed to the Director and copied to the IT or Human Resource Manager of the corporate agency. Similarly. for the schools, the cover letter was addressed to the principal and copied to the CS/IT teacher. Both letters explained the purpose of the survey and requested cooperation in completing the questionnaires provided by the field officer.

4. Visited 82 of the 86 schools teaching CS to interview students selected by the schools. Questionnaires were couriered to the Levuka and Kadavu schools, and posted to two schools in the Sigatoka area which could not be visited.
5. Interviewed stakeholders from selected government departments, commercial businesses and non-government agencies.
6. Conducted six focus group interviews in Suva, Lautoka and Labasa. The focus groups comprised CS/IT students, USP Foundation students and personnel from invited agencies.
7. Conducted a two-day symposium to share the research results, deliberate on related issues, collect more data and information, and exchange the latest knowledge and skills of computer education in secondary schools. The participants deliberated on the research findings and proposed recommendations for possible revision of the CS/IT curriculum.
8. Visited two schools to conduct semi-structured interviews and observation of facilities. These schools were identified as 'best practice' schools by the symposium and focus group participants.
9. Reviewed the CS prescription of curriculum of the US, Japan and Tonga.
10. Held a peer review to obtain a critical view of academics and stakeholders on the research findings.

Sampling

Eighty-six schools offer CS/IT education. All these schools were sent questionnaires. Of theses, 82 were visited in order to interview teachers. Students of 26 schools were also interviewed. Twenty-seven agencies and other stake holders were visited for interviews. Table 1 shows the number of forms that were sent and returned. See Annex 6 for a listing of all agencies and teachers that returned completed questionnaires.

Table 1: Questionnaires sent and returned

Sector	Questionnaires sent	Responses received (as of 20/3/03)	% Returned
Agencies	40	27	68%
Students	312	217	70%
Teachers	86	44	51%
Total	**438**	**288**	**66%**

- In the first stage of selection, all secondary schools teaching CS/IT in Fiji (2002) were identified. These are listed in Annex 5. As this represented 55% of the total number of secondary schools in Fiji, it was decided to interview at least one CS/IT teacher from each of these 86 schools.
- Interviewing all students taking CS/IT would have made a very large sample, so schools were divided into districts in the Central, Western and Northern divisions as listed in Annex 5, and then almost 30% of each division's schools were randomly selected. These included 14 of the
- Forty selected agencies from the Suva area were identified for interview in consideration of their large scale use of IT, their recent employment record of recent school-leavers with some IT skills, and the keen interest they had shown during meetings with researchers in the past with regard to CS/IT education in Fiji schools.
- Two schools were identified as 'best practice' case studies for this research. Nadi Muslim College was selected in recognition of their facilities and school data management system, while Labasa Sangam College was selected in recognition of its proactive role in Labasa in promoting CS/IT education. Initially, these two schools were invited to present a paper during the symposium. Arising from the participants' questions and discussion, it was found that the roles of the principal and the management were critical, so visits were made to the schools to collect more in-depth information regarding their facilities, and the roles of management and principals.

- The participants of the symposium were selected in consideration of their keen interest in the CS/IT learning and teaching courses at all levels. Participants were from secondary schools, the MOE, tertiary institutions such as the USP, the Fiji Institute of Technology (FIT), Lautoka Teachers' College (LTC), the Training and Productivity Authority of Fiji (TPAF),[3] APTECH, Central Queensland University (CQU), Information Technology and Computing Services Section in Fiji (ITC), and from donor agencies, such as the Japanese International Cooperation Agency (JICA), the United Nations (UN) and Australian Assistance for International Development (AusAID).

Schedule

The CS/IT research was initiated in late December and finalised in mid-july.

Date	Activity
23rd December–10th January, 2003	Collected baseline data from MOE and finalized the literature review.
12th – 14th January	Finalised questionnaires.
14th – 17th January	Completed sample selection, recruited field officers and conducted pilot interviews.
20th Jan – 14th February	Conducted interviews in VitiLevu and VanuaLevu
15th Feb – 10th March	Completed the initial analysis and prepared the initial report.
27th – 28th March	Symposium on Evaluation of the Computer Science Curriculum in Fiji Secondary Schools.
1st – 14th April	Assembled the workshop proceedings and analyzed information from the workshop.
15th April – 15th August	Consolidated the above into the final report and held a peer review on the report.
31st August	Launched the final report and the Web page for discussion.

3. Formerly the Fiji National Training Council

CHALLENGES

There were a number of challenges faced by the research team in the conduct of this research. However, steps were taken to minimize them as much as possible.

Data collection

- It was very time-consuming to obtain baseline data from the Ministry of Education, such as a list of schools teaching CS/IT and their contacts, name, gender/subject and salary breakdown of all secondary schools teachers, urban/rural breakdown of secondary schools, etc.
- In a few schools, the principals were not very cooperative about filling in the questionnaire. Time constraints resulted in questionnaires being left with those teachers who did not have time to complete the questionnaire during the visit.
- In some schools, we were allowed to interview only a few students, fewer than our target of at least 12 students from selected schools. To some extent this was compensated for, as teachers in other schools requested that most of the students in their form be interviewed.
- The focus group interviews in Suva had a lower turnout than expected but this was improved by organizing other focus group interviews during the weekday.
- Although agencies were the smallest number in the sample, much time was spent on following up interviews with them. Most of the first attempts were unsuccessful.
- Some data collection was interrupted due to the abrupt departure of a field officer.

Limitations of the research

In this research, interviewing students and teachers in the school environment through the questionnaire produced different results from the focus group interviews. It is assumed that requesting students and teachers for personal details like name, address and contact may have skewed their responses when filling in the questionnaires in schools. Students and teachers completing the questionnaires were uncomfortable with the possibility of their comments being made public, despite assurances from the researchers. On the other hand, in the focus group discussions, students and teachers provided more in-depth responses, despite our request for personal details. Similarly in the CS symposium, the participants aired many grievances which were not usually reflected in the questionnaire results.

In the analysis, we have compared Fiji's CS/IT prescription with those of the United States of America, Japan, and Tonga. However, as apparent, Fiji is at the beginning stages of CS/IT education, while the USA and Japan are at a more developed stage. Tonga is interesting in that its CS/IT prescription is very comprehensive and its focus is on practice. Therefore, any conclusion that may be drawn from this comparison has to be treated with caution.

Computer Science teachers in Labasa

ANALYSIS

Section 1: Participant Analysis: Description of CS/IT Students and Teachers

The students and teachers were the main participants of the baseline research; the team considered students as those learning CS/IT and the teachers as those teaching CS/IT in secondary schools. Data were collected on their ICT environment, both at school and at home. Information about the teachers' academic background, experience, salary, status, and incentives for teaching was also collected.

We began with analysing the data from the students' interviews and compared them with the data from the teachers' interviews wherever significant.

Age and form of students

Most students (93%) who took part in the research were from Forms 6 and 7 (see Table 2). Although the students' age was not asked for in the interview questionnaire, according to the MOE (2000:84), most of these students are between 16 and 19 years old. (See Annex 1 for educational structure in Fiji).

Table 2: Students by present form

Form 5	15 (7%)
Form 6	89 (41%)
Form 7 (USP Foundation 6%)[4]	113 (52%)
Total	**217 (100%)**

Q1: In which form are you presently studying?

Gender of students and teachers

In an analysis of students taking CS/IT courses in schools, it was found that there were slightly more female students than male students (Table 3a). However, at the tertiary level at USP, enrolment figures show that the number of female students giving CS/IT as their first or second major is much lower than the number of males (Table 3b). This variation is discussed under the section: **Reason for taking CS/IT.**

Table 3a: Teachers and students by gender

	Teachers	Students
Male	26 (59%)	100 (46%)
Female	18 (41%)	117 (54%)
Total	**44 (100%)**	**217 (100%)**

Table 3b: USP CS students by gender

	2003	2002
Male	470 (74%)	419 (72%)
Female	165 (26%)	162 (28%)
Total	**635 (100%)**	**581 (100)**

Source: USP Statistics, 2003

4. The USP Foundation students mentioned in Table 2 were students participating in the focus group discussion. They were requested to fill in the questionnaire, based on their experience of learning CS/IT at Form 6 level in the previous year (i.e., 2002).

Ethnicity of students and teachers

In the questionnaire, we asked the teachers to state their ethnicity but did not ask the students to do so. However, it was possible to obtain the ethnicity of the students based on their names. A high number of Indo-Fijians were recorded as taking the CS/IT classes (Table 4).

Annex 2 shows that over 60% of Form 7 students are Indo-Fijians and just over 30% are Fijians. This is expected, as of the 3822 students enrolled in Form 7 in 2002, 66% were Indo-Fijians and 31% were Fijians.[5] This issue will be discussed later under **Examinations**.

Table 4: Students and teachers by ethnicity

Ethnicity	Teachers	Students
Indo-Fijians	35 (80%)	152 (70%)
Fijian	8 (18%)	52 (24%)
Chinese	0	6 (3%)
Others	1 (2%)	7 (3%)
Total	**44 (100%)**	**217 (100%)**

Internet access for students and teachers

Internet access varies in Fiji. According to the World Telecommunications Development Report published by ITU in 2002,[6] Fiji has 610.05 Internet users per 10,000 population, while Samoa has 221.73 and Tonga has 292.34. Table 5 shows that 21% of the students and 16% of the teachers had Internet access. The survey indicated that students had slightly greater access to the Internet at home than did teachers. Teachers attributed their low access to high Internet charges. This is confirmed by responses such as:

> *"I have Internet at home but with minimal usage because the cost is too high." Nasinu Muslim Secondary School.*
> *"Internet is accessible at work, and it is too expensive anyway. We have just moved to a new place and it does not have phone lines." Adi Cakobau School.*

When we examined Internet access by ethnicity (Table 6), 60% of the students and 86% of the teachers with access to the Internet were Indo-Fijian. The Chinese also had a relatively high figure of access, considering that they were very few in number.

Table 5: Students and teachers with Internet connection at home

	Teachers	Students
Yes	7 (16%)	46 (21%)
No	28 (64%)	171 (79%)
Not stated	9 (20%)	
Total	**44 (100%)**	**217 (100%)**

Table 6: Ethnicity of teachers and students with Internet connction at home

Ethnicity	Teachers	Students
Indo-Fijians	6 (86%)	28 (60%)
Fijian	1 (14%)	10 (22%)
Chinese		5 (11%)
Others		3 (7%)
Total	**7 (100%)**	**46 (100%)**

Q 27 (T): Does your home computer have Internet connection?
Q 16 (S): Do you have access to the Internet at your home?

5. Accessible online at <http://www.fijichris.gov.fj/Dr/DB-MOE11.htm>
6. Accessible online at <http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet02.pdf>

Reasons for taking CS/IT

Students were asked why they were taking CS/IT courses in school. Three major reasons were given.

1. CS/IT will be useful when seeking work.
2. Preparation for a career in the ICT field.
3. Interest and entertainment.

About 64% of the students stated that they learn CS/IT because it will be useful in their future job. Another 22% indicated that they were thinking of a future career in ICT. In the focus group interview, students indicated that they wanted to get white collar jobs and that a career in ICT paid well. Students expressed the view that everything was heading towards new technology now and they wanted to be part of this development. Some students stated that they wanted to learn more about the Internet and the use of emails and online resources.

In analyzing the data further, in terms of gender (Table 7a), it was found that 48% of the female students and 36% of the male students regarded CS/IT as a useful subject when it came to looking for a job, while 25% of the male students and 20% of the female students saw CS/IT as a career option. Table 7a, which reflects the low enrolment of females in the CS/IT major at USP, indicates that female students tend to see CS/IT as an administrative or office tool, while the male students tend to be interested in CS/IT as a career. USP enrolment statistics (Table 7b) show a similar tendency (CS: female 25% and male 75% and IT: female 45% and male 55%). It is possible that females prefer to study IS (Information Systems) as this is more application-based than CS.

Table 7a: Reasons for studying CS by students

Reasons	Male	Female
Useful when looking for a job	36 (36%)	56 (48%)
Plan to have a career in IT	25 (25%)	23 (20%)
Interested to learn computing	18 (18%)	19 (16%)
Keep up-to-date with modern technology	7 (7%)	7 (6%)
Not stated	14 (14%)	12 (10%)
Total	**100 (100%)**	**117 (100%)**

Q4: Please clearly state the reasons for selecting CS.

Table 7b: CS and IS students at USP by gender (2003)

	CS	IS
Male	470 (74%)	664 (55%)
Female	165 (26%)	547 (45%)
Total	**635 (100%)**	**1211 (100%)**

Source: USP Statistics, 2003.

Analysis of teachers' responses

There are factors that impact on student achievements; only some of which are easily defined and measured. According to Hanushek, Kain and Rivkin (1999), the most important factor for student achievement is teacher quality. Teacher quality can be contextual and individualistic. In order to describe CS/IT teachers in Fiji, we used quantifiable indicators. Research suggests that students learn more when teachers have more than a few years of experience, have high academic skills, teach in the field they are trained in and participate in professional development programs (NCES, 2000). Among indicators measuring teacher's quality, we used the following:

1. age and teaching experience;
2. teacher qualifications and academic background;
3. teaching subjects and levels, and relevant training;
4. job status;
5. salary range;
6. future plans;
7. incentives for the job; and
8. environment and interest in ICT.

Age and teaching experience

Teachers were asked questions about their age, salary and years of teaching experience at secondary school. The general picture arising out of this research was that CS/IT teachers are young and have little experience: 58% of teachers are under 25years of age, 76% are under 31 years of age and 85% had 5 years or less teaching experience (Table 8).

Table 8: Teachers' age by experience

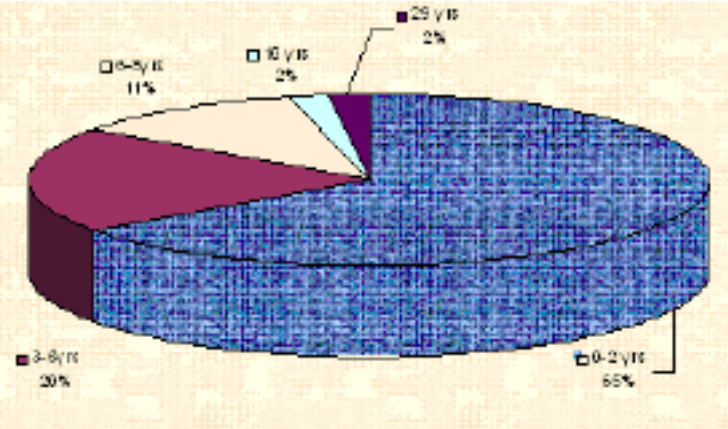
	Years of teaching Experience					
Age	**0-2**	**3-5**	**6-8**	**10**	**29**	**TOTAL**
~25	18	8				26
~30	5	1	1			7
~35	3		2	1		6
~40	1		1			2
~45					1	1
Not stated	2					2
Total	**29**	**9**	**4**	**1**	**1**	**44**

Q22: As at the end of 2002, how many years had you been teaching?

We can suggest a number of reasons for this, confirmed in focus group interviews. First, CS/IT is a relatively new subject which commenced in 1996 in Fiji. Second, a high 82% are Grant-in-Aid teachers. Third, teaching is not considered a lucrative job for new CS/IT graduates and they enter into teaching because they have no other offers. In focus group interviews, we were informed that many teachers took up teaching as 'stop gap' work. Fourth, most CS/IT graduates who do not have relevant teaching experience are Grant-in-Aid teachers and may not have long term job security .

> *"Because I was unable to secure any other forms of employment and had no other option as I needed to stay in this area (Labasa) and there were no other jobs apart from teaching". Labasa College*

Graph 1: Teachers' age by years of teaching experience



Q22: At the end of 2002, how many years had you been teaching?

Teacher qualifications and academic background

Of the total number of teachers who responded, 50% have a degree and 32% have a diploma as shown in Table 9a. According to the MOE data in Table 9b, 54% of all secondary school teachers are graduates and 38% have a diploma. The teachers were not asked whether they held a teaching certificate, but it was clear from the responses received on the question on qualifications and from the focus group interviews that the majority of CS/IT teachers did not have a teaching qualification. A diploma in CS was the minimum requirement for teaching CS in secondary schools, especially at higher levels, not a diploma in teaching. However, when it is difficult to hire qualified personnel, some special arrangement is made whereby teachers without CS qualifications are asked to teach CS courses.

Table 9a: Qualifications of CS teachers by job status

Qualification	Civil Service teachers	Grant in Aid teachers	Total
Masters		3	3 (7%)
Degree	6	16	22 (50%)
Diploma	2	12	14 (32%)
Certificate		5	5 (11%)
Total	**8 (18%)**	**36 (82%)**	**44 (100%)**

(T)Q4: What are your qualifications, and the major in each?.

Table 9b: (Ministry of Education) Secondary school teachers classified by qualifications (2002)

Qualification	Race			Sex		Grand Total
	Fijian	Indian	Other	M	F	
Graduates (54%)						
Trained	595	1200	129	917	1007	1924
Untrained	81	215	12	159	149	308
Diploma (38%)						
Trained	718	654	50	720	702	1422
Untrained	62	100	4	92	74	166
Completed Form 7						
Trained	107	39	5	104	47	151
Untrained	38	28	7	43	30	73
Completed Form 6/ Higher						
Trained	20	5	2	12	15	27
Untrained	16	5	0	12	9	21
Completed Form 5						
Trained	21	5	4	13	17	30
Untrained	7	2	1	6	4	10
Completed Form 4 & Lower						
Trained	1	3	2	4	2	6
Untrained	4	0	0	4	0	4
TOTAL	**1670**	**2256**	**216**	**2086**	**2056**	**4142**

Table 10 gives the data on where teachers obtained their qualifications: 77% studied in Fiji, 55% of them being graduates of the USP (Table 11). The second largest group is the FIT graduates. Three teachers have Masters Degrees from overseas universities (India, USA, and Pakistan). Masters graduates in IT are few, as reflected in Table 5.1 of USP Statistics of 2001. In 2001, only 16 students were enrolled for the Postgraduate Diploma in Computing Science program at the USP[7]. This could, however, be under-represented as MSc in CS is usually described as Masters in Science, so the exact title (e.g. MSc in CS, MSc Info Sys) is not clear.

Table 10: Qualification by country of CS teachers

Country	Masters	Degree	Diploma	Certificate	Total
Fiji		18	12	4	34 (77%)
India	1	1			2 (5%)
PNG		1			1 (2%)
Egypt			1		1 (2%)
USA	1	1	1	1	4 (10%)
UK		1			1 (2%)
Pakistan	1				1 (2%)
Total	**3 (7%)**	**22 (50%)**	**14 (32%)**	**5 (11%)**	**44 (100%)**

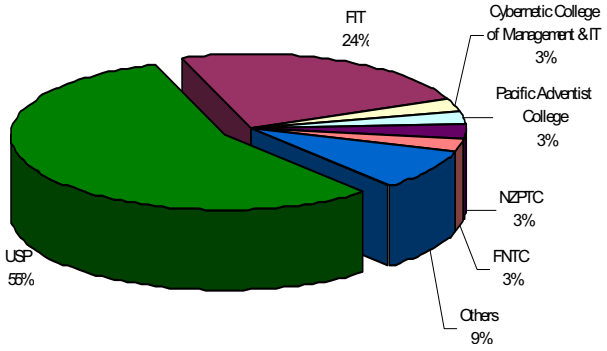
(T)Q 5: Please state the country and institute where you studied for any qualifications relating to CS/IT.

7. Accessible online at <http://www.fijichris.gov.fj/Dr/DB-USP11.htm>

Table 11 shows where the teachers obtained their training. A high pertentage of them trained at the USP.

Table 11 and Graph 2: CS teachers and whe

USP	19
FIT	8
Cybernetic College	1
Pacific Adventist College	1
NZPTC	1
FNTC	1
Others	3
Total	**34**



Teaching subjects and levels, and relevant training

In Fiji, teachers are required to teach two or more subjects. Table 12 shows the subjects taught by the teachers in the study. Nineteen (43%) are teaching mathematics and 42 are teaching CS/IT as their main subject. Of all the teachers interviewed, 93% are teaching CS/IT at Form 6 level, as well as teaching CS and other subjects at other levels as identified in Table 13a.

Table 12: Main teaching subjects by percentage of teachers

Subjects	Percentage of teachers
Computer Science	42 (95%)
Mathematics	19 (43%)
Accounting	7 (16%)
Economics	3 (7%)
Physical Education	1 (2%)
Physics	2 (4%)
Religious Studies	2 (4%)
Vernacular	2 (4%)

Q14: What are your main teaching subjects? (The total exceeds 44, as respondents gave multiple responses.)

Table 13a: Grade and subject taught by CS teachers

Grade	Computer Science	Mathematics	Accounting	Others
Form 1	2 (4%)	1 (2%)		
Form 2	2 (4%)	1 (2%)		
Form 3	7 (16%)	4 (9%)	2 (4%)	1(2%)
Form 4	8 (18%)	5 (11%)	2 (4%)	1 (2%)
Form 5	33 (75%)	14 (32%)	5 (11%)	10 (23%)
Form 6	41 (93%)	18 (41%)	6 (13%)	10 (23%)
Form 7	24 (55%)	8 (18%)	1 (2%)	3 (7%)
Total no. teaching a particular subject	**42 (95%)**	**19 (43%)**	**7 (16%)**	**12 ((27%)**

Q14: What are your main teaching subjects? The % is calculated with 44 as the total number interviewed.

Regarding teaching the subject that they studied at a tertiary institution, 18% of the teachers did not have the relevant background in higher education (Table 13b). However, 81% of all the 44 teachers have CS/IT background.

Table 13b: CS teachers by their majors in tertiary institutions

CS	12 (27%)
CS/IS/IT subject	5 (11%)
CS and another non-IT subject	19 (44%)
Other subject	8 (18%)
Total	**44 (100%)**

Q4: What are your qualifications? Please specify the major in each. (Check all that apply)

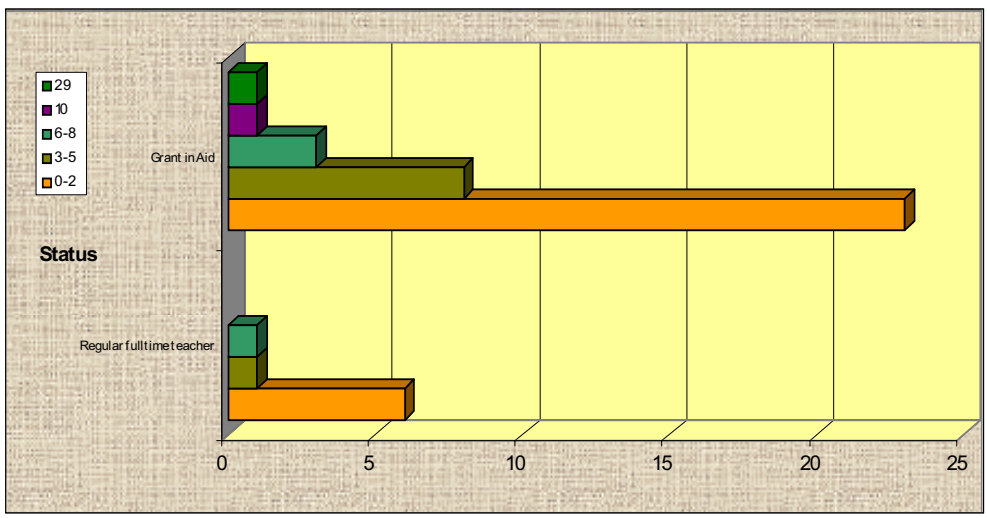
Job status

Of the 44 teachers, 82% are Grant-in-Aid teachers, while 18% are Civil Service teachers (Table 14). Annex 14 provides the Ministry of Education's definition of Civil Service and Grant-in-Aid teachers. There is a strikingly high number of Grant-in-Aid CS/IT teachers. This subject will be discussed in more detail in Section 3.

Table 14: Status by years of teaching experience of CS teachers

Status	0-2	3-5	6-8	10	29	Total
Civil service teachers	6	1	1		8	
Grant in Aid	23	8	3	1	1	36

Graph 3: Status by tears of teaching experience of CS teachers



Salary range

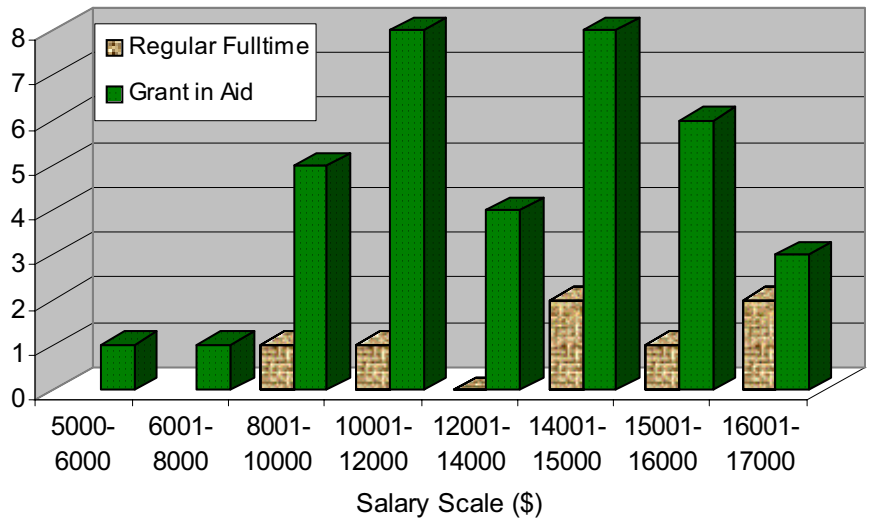
Teachers are paid according to Public Service Commission salary scales. In recruiting teachers, qualification, experience and subject areas are taken into consideration. Data from our interview responses show that teachers' salaries range from F$5,000.00 to F$17,000.00. One observable tendency is that a higher qualification attracts a higher salary (Table 15). The present CS/IT teachers' salary is not competitive when compared to salaries in the private sector, especially in the IT area[8]. In the focus group interview, most of the teachers agreed that, compared to their colleagues in the private sector, they were paid a "very measly" salary. Considering the pros and cons of working as a teacher, some teachers stated during the symposium that they were looking for a better job with a higher salary and better conditions.

Table 15: Salary scale by qualification

Salary Scale (F$)	Total	Master	Degree	Diploma	Certificate	Civil Service teachers	Grant in Aid teachers
5000-6000	1 (2%)			1		0	1
6001-8000	1 (2%)				1	0	1
8001-10000	6 (14%)		1	4	1	1	5
10001-12000	9 (20%)		2	6	1	1	8
12001-14000	4 (9%)		2	2		0	4
14001-15000	10 (23%)		9		1	2	8
15001-16000	7 (16%)	2	4		1	1	6
16001-17000	5 (12%)	1	4			2	3
Not Stated	1 (2%)			1		1	0
Total	**44**	**3**	**22**	**14**	**5**	**8**	**36**

(T) Q6: What is your present annual salary?

Graph 4: CS teachers' post by salary



8. Interviews with the IT personnel from a few large scale private companies located in Fiji revealed that the minimum starting salary for new IT recruits is $15,000 – $19,000 for technicians and anything from $19,000 – $23,000 for programmers.

Future plans

In response to the question: *Do you plan to continue teaching CS in the near future?* thirty four (77%) of the 44 teachers indicated that they would continue teaching while ten (23%) responded that they would not continue or were not sure (Table 16a). Table 16b shows that 82% of the 34 CS teachers who plan to continue teaching have some CS/IT background.

During the focus group interview, only four out of 13 teachers stated they would continue teaching; they love teaching, find it easy to work with students, enjoy their work and have the opportunity to work part-time. Others, however, said that it depended on a number of factors, such as whether or not their contract is renewed by the MOE and the possibility of being offered a better job, in which case they would resign because teaching is a 'stop-gap' job. Teaching CS/IT in school is preferable to being unemployed. They would like the MOE to play a more pro-active role in providing them with relevant ICT training and to upgrade their post to Civil Service teachers status.

In examining those leaving CS/IT teaching, three times more Indo-Fijian than Fijian teachers resign and since 80% of teachers of CS/IT courses are Indo-Fijians, as shown in Table 17, it is likely that resignation causes a high turnover. This high turnover is also reflected in the general IT sector in Fiji. Annex 3 shows that out of the 12 staff who resigned in 2001 from the Information Technology and Computing Services (ITC) Section in the Ministry of Finance, 11 of them had IT skills.

Table 16a: Plans to continue teaching by status

	Total	Civil service	Grant-in-aid
Yes	34	6	28
No	4	1	3
Not sure	6	1	5
Total	44	8	36

(T) Q18: Do you plan to continue teaching CS in the near future?

Table 16b: CS teachers' major by plans to continue teaching

	Yes	No	Not sure
CS/IT	13 (30%)	3 (7%)	3 (7%)
CS/another subject	15 (34%)	1 (2%)	3 (7%)
Non-IT subject	5 (11%)		
Not stated	1 (2%)		
Total	**34 (77%)**	**4 (9%)**	**6 (14%)**

(T) Q18 and Q4

Table 17: Summary of resignations, retirements and deaths - 2001

	Secondary School Teachers			
	Fijians	**Indians**	**Others**	**Total**
Resignations	30	108		138
Retirements	2			2
Deaths	4	1	1	6
Total	**36**	**109**	**1**	**146**
Total No. of secondary school teachers	**1587**	**2107**	**200**	**3894**

Source: Ministry of Education Annual Report 2001:16

Incentives for the job

Identifying the incentives to retain CS/IT teachers in their jobs is crucial. In answer to the questionnaire request: *Clearly state what incentives schools, the MOE, tertiary institutes, businesses and other stakeholders should provide for teachers in the CS field,* 77% of the teachers indicated that a good incentive for continuing in a job is training; 34% said that schools should be provided with better hardware or infrastructure; 14% said job security, and 7% said a salary increase (Table 18). The teacher participants in the symposium stated that a secure post as Civil Service teachers and an increase in salary would be good incentives.

Two types of training are involved: training for a teaching certificate and training in the latest technology. Teacher training will give teachers a certificate that will lead to better paid positions compared to those without. Also, considering the changing trends in the ICT industry, the teachers' request for training is reasonable. There are many new developments and opportunities. Open source movement is one of these and training in the use of Linux is seen as benefiting many people, as it will allow trainees to develop software source code voluntarily and share the work. Teachers could become developers and obtain honour for their work. Gaining technological knowledge and skills is a strong incentive to keep teachers in their position. However, according to the MOE, no such training has been provided for the past three years. Concern was raised on how these teachers could refresh their knowledge and skills.

Table 18: Teachers' suggestions for incentives to continue teaching

Suggestions	No.	Percentage
Training	34	77%
Provide updated facilities	9	20%
To have enough PCs for student	6	14%
To be given Civil Service teachers post	6	14%
ED courses not to be compulsory	4	9%
Extra classes from internet	3	7%
Better pay	3	7%
Not stated	1	2%

(T) Q20: Please clearly state what incentives the schools, the Ministry of Education, tertiary institutes, businesses and other stakeholders should provide for teachers in the CS field. (The total exceeds 100% as this was a multiple response.)

Computer ownership and Web creation

According to the ITU 2003 report, Fiji had 610.05 Internet users per 10,000 population and 4.88 PCs per 100 inhabitants in 2002[9]. Our data showed that 50% of the teachers have a PC at home and 16% of all the teachers interviewed have Internet access. One teacher (2%) has a personal Web page.

*9. Accessible online at <http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet02.pdf>

Table 19: Teachers' access to PC, the Internet and own Web page

	PC at home	Access to Internet	Own Web page
Yes	22 (50%)	7 (16%)	1 (2%)
No	22 (50%)	28 (64%)	35 (80%)
Not stated		9 (20%)	8 (18%)
Total	**44**	**44 (100%)**	**44**

(T) Q25: Do you have a computer at home? Q27: Does your home computer have Internet connection? Q 28: Do you have your own Web page?

Teachers' areas of interest in CS/ICT

Many teachers (64%) indicated an interest in learning Web design and 48% showed an interest in learning networking skills (Table 20). Almost 60% indicated that their interest in the fields they ticked on the questionnaire was to acquire more knowledge, while 40% stated that the field could have business potential (Table 21). Both Web page and networking skills could be utilized in teaching and for business opportunities. The least favourite among the provided fields is Online Learning (16%) and Desktop Publishing (21%). Both could be used to make their teaching effective but teachers did not show a strong interest. In the focus group interview, however, teachers stated that if they were to obtain further education, it would be in Accounting and similar fields in order to acquire qualifications that are more marketable in the private sector, as they would have a higher salary and more secure jobs.

Table 20 and Graph 5: CS/IT teachers' interest in learning an IT subject by preference

Web Design	28 (64%)
Networking	21 (48%)
Computer Graphics	18 (41%)
IP Technology	17 (39%)
Operating System	14 (32%)
Database Management	11(25%)
Desktop Publishing	9(21%)
Online Learning	7(16%)

(T) Q9: Is there any specific topic in CS that you would like to learn? (Tick all that apply) (Total exceeds 100% as this was a multiple response.)

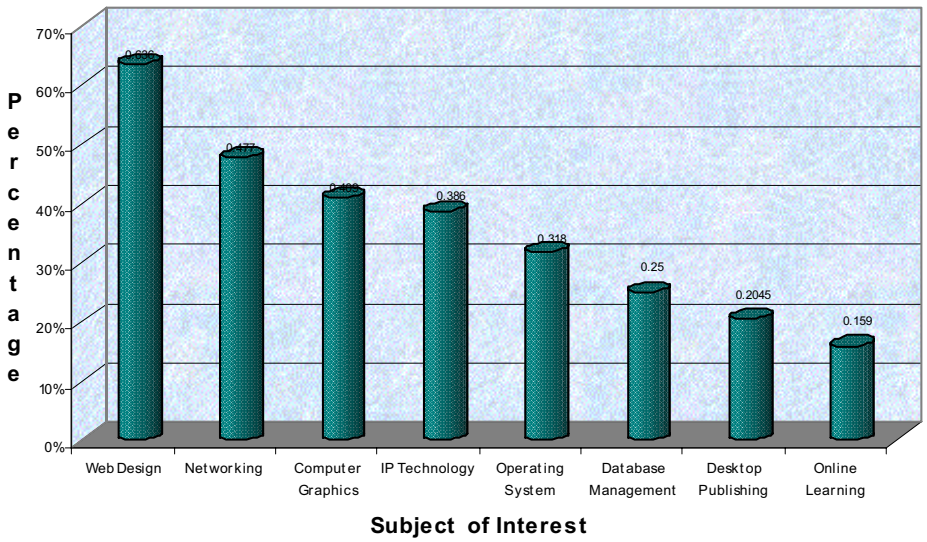
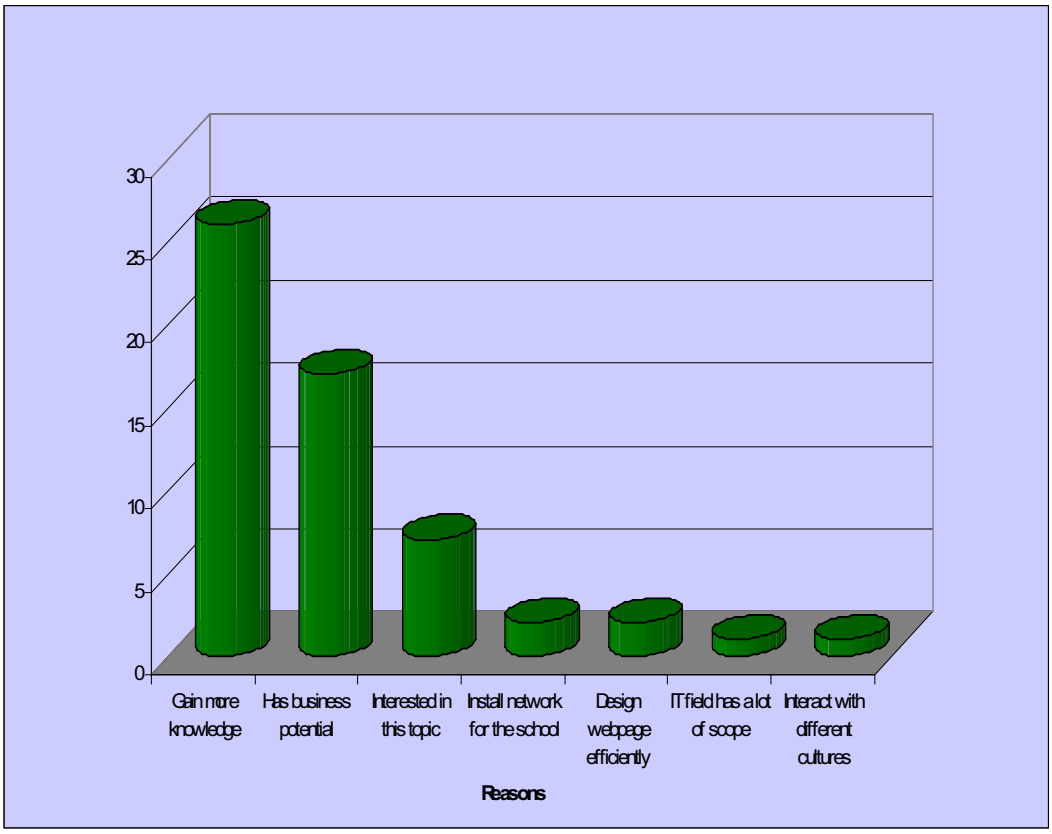


Table 21 and Graph 6: Reasons for interest in a particular field

Reasons	Percentage
Gain more knowledge	26 (59%)
Has business potential	17 (39%)
Interested in this topic	7 (16%)
Install network for the schoo	l2 (5%)
Design webpage efficiently	2 (5%)
IT field has a lot of scope	1 (2%)
Interact with different cultures	1 (2%)

(T) Q10: Please explain why you are particularly interested in this area of CS.
(Total exceeds 100% as this was a multiple response.)



Summary

Typically, CS/IT teachers in Fiji are Indo-Fijians, in their middle 20s with less than 2 years teaching experience, working as Grant-in-Aid teachers, having studied in Fiji and majoring in CS/IT. Barring any incentives to encourage them to continue teaching, they would take up more lucrative job offers in the private sector if these become available.

Typically, students taking CS/IT as a subject in Fiji secondary schools are between 16 and 19 years old, in Forms 6 and 7, are Indo-Fijian, more likely to be female than male, and interested in CS/IT mainly for career purposes. Students tend to have better IT skills than their teachers and also have greater access to the Internet than most teachers.

All Saints Secondary School computer lab

Labasa Sangam Form Seven students

Section 2: Problem Identification

Students and teachers

Students and teachers raised a number of issues and concerns. Some of the major problems identified were:

- the theoretical curriculu
- the lack of teaching skills of CS teachers;
- the lack of access to computers;
- the extended time taken to have school PCs repaired;
- the use of old PCs;
- the slow rate of Internet access;
- the high cost of Internet access.

There were also problems relating to the status of CS/IT teachers and the impact on the student, limited training opportunities and limited networking among teachers. These will be addressed in Section 3.

On the problem of the curriculum being too theoretical, 60% of the students stated that CS classes were too theoretical while 50% of teachers stated that students' attitude was a problem in learning (see Table 22). That the CS/IT courses were too theoretical could be explained by several factors: the design of the curriculum emphasizes rote learning; the lack of knowledge of teaching CS/IT amongst the teachers; and the lack of teaching resources, such as texts and digital equipment. As one student commented:

"The curriculum is boring most of the time. Some of us are learning how to use the Internet from our siblings at home and those things are more interesting than learning [computer] history at school. The curriculum should be made more interesting." (Labasa Muslim College)

The issue of curriculum will be addressed in depth later.

Thirty three percent of all the students and 43% of teachers identified a lack of trained teachers as a problem. In the focus group interview, students noted that the knowledge, skills and poor attitude of some teachers were serious issues. Some students in the focus group interviews stated that the teachers were not thorough enough and attended classes unprepared; other teachers dictated copious notes and tended to rely heavily on textbooks. A number of teachers' computing knowledge was too basic. One teacher admitted that some students were more knowledgeable than teachers in using basic applications such as Microsoft Word and Excel. On the other hand, teachers identified equipment as a major concern. Many teachers (80%) identified the long time it takes to have PCs repaired as a barrier to teaching and learning and 73% of students and 84% of teachers identified the lack of PCs as another concern. We will discuss this in depth later (p. 35).

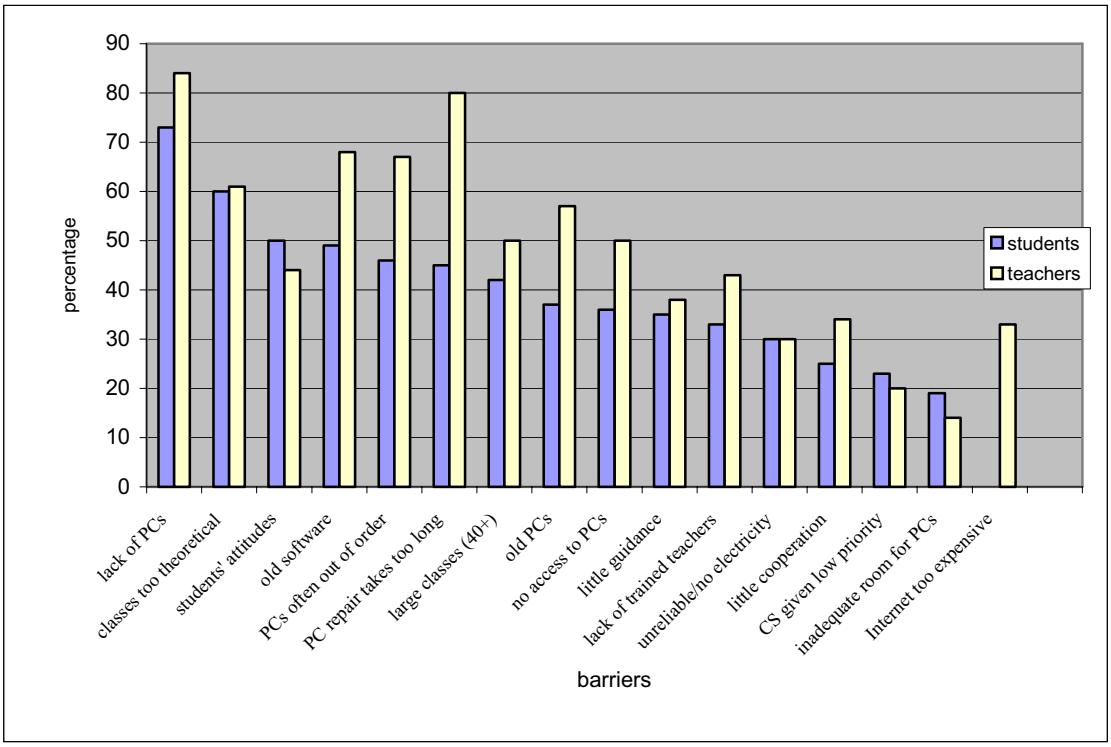
For a CS/IT curriculum to be successful in schools there must be adequate technical support. There must be equipment, educational materials and access to the latest technologies and networking facilities. In this research, the problem of lack of computers (84%), the long time it takes to repair a computer (80%), and the general lack of access to computers were identified as major problems, particularly in rural schools and those schools far from maintenance services centres.

The limited Internet access because of cost and availability was seen as a major problem by teachers. Over 75% of the teachers noted that an Internet connection was too expensive for students.

Table 22 and Graph 7: Barriers to teaching and learning CS in schools

Barriers	Students	Teachers
Lack of PCs	158 (73%)	37 (84%)
Classes too theoretical	130 (60%)	27 (61%)
Students' attitude	109 (50%)	19 (44%)
Old Software applications	106 (49%)	30 (68%)
PCs often out of order	100 (46%)	29 (67%)
Maintenance of PCs takes long	98 (45%)	35 (80%)
Large classes (40+ students)	91 (42%)	22 (50%)
Old PCs	80 (37%)	25 (57%)
Students have no access to PCs during CS classes	79 (36%)	22 (50%)
Little guidance to students by teachers	76 (35%)	17 (38%)
Lack of trained teachers	72 (33%)	19 (43%)
Lack of electricity/ frequent power cuts	65 (30%)	13 (30%)
Little cooperation from parents and senior staff	54 (25%)	15 (34%)
Little priority given to teaching CS	50 (23%)	9 (20%)
Inadequate facilities to house PCs	41 (19%)	14 (32%)
Internet connection to too expensive for students to use		33 (75%)
	217	44

(S) Q21: Indicate whether any of the following are barriers to learning CS in your school.
(T) Q35: Indicate whether any of the following are barriers to teaching CS at your school.



Agencies

ICT skills of school leavers required by agencies

Agencies were asked about the skills they expected recent school leavers to have. Table 23 shows that 46% expected some level of ICT skill, while 15% indicated that they required no prior skill.

Table 23 and Graph 8: Level of general computer skills required of school-levers by agencies, on average

Level of Skills	Average %
Sufficient Skills	10 (36%)
Minimum Skills	3 (10%)
No Skills	4 (15%)
Not stated	10 (39%)

(A) Q6: Please rate what level of skills your agency requires from school-leavers in the use of these applications.

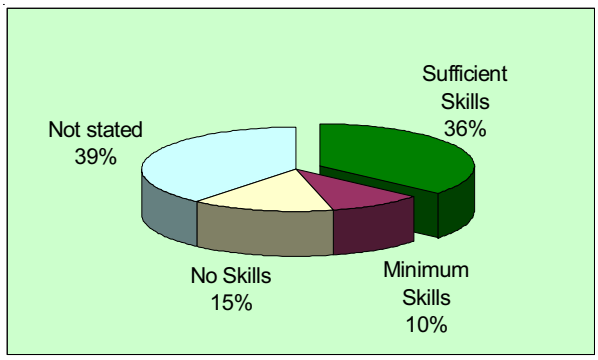


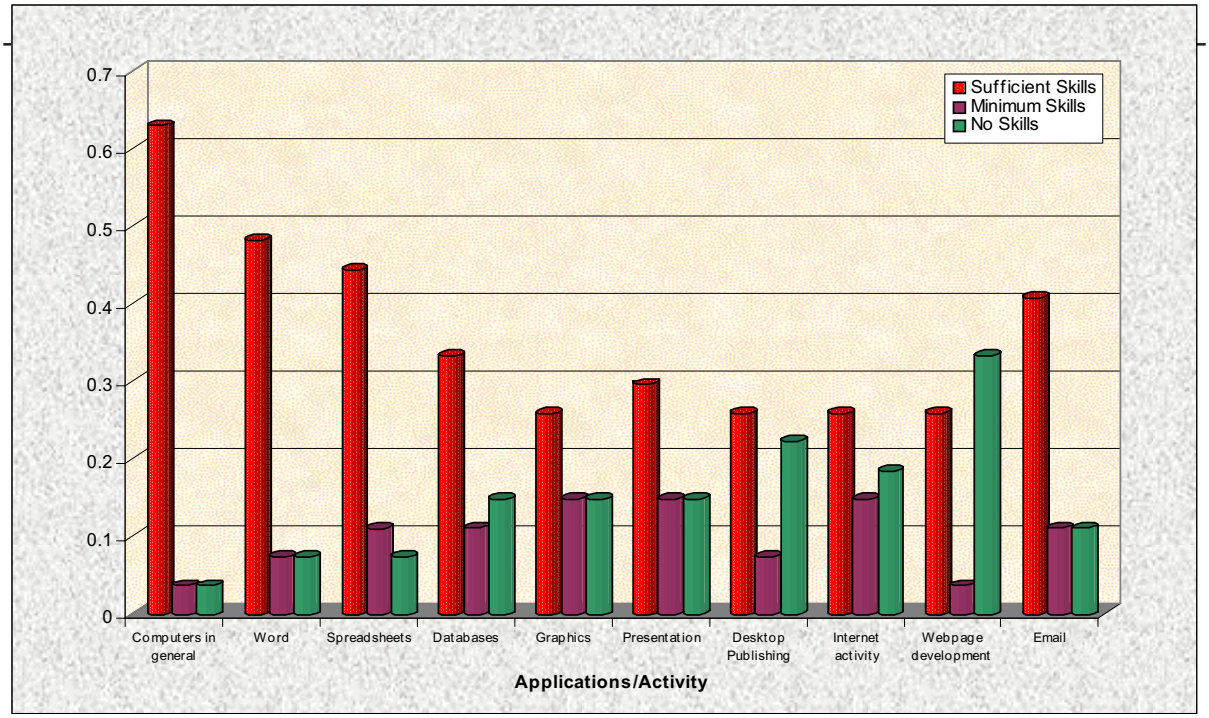
Table 24 shows that agencies require students to have sufficient skills in computers in general (63%), word processing (48%), and e-mail (41%), while fewer skills are required for Webpage development and Desktop publishing, although all 27 agencies interviewed have Web pages. In discussions with a number of agencies, it was clear that the level of expertise needed varied from one agency to another. A number of companies indicated that advanced skills were not necessary and it depended on the type of work that is required to be undertaken. If it was for inputting data as in the banks, then basic computer knowledge was all that was needed. Some agencies have their own internal training programs which their new recruits undertake to familiarise themselves with company operations.

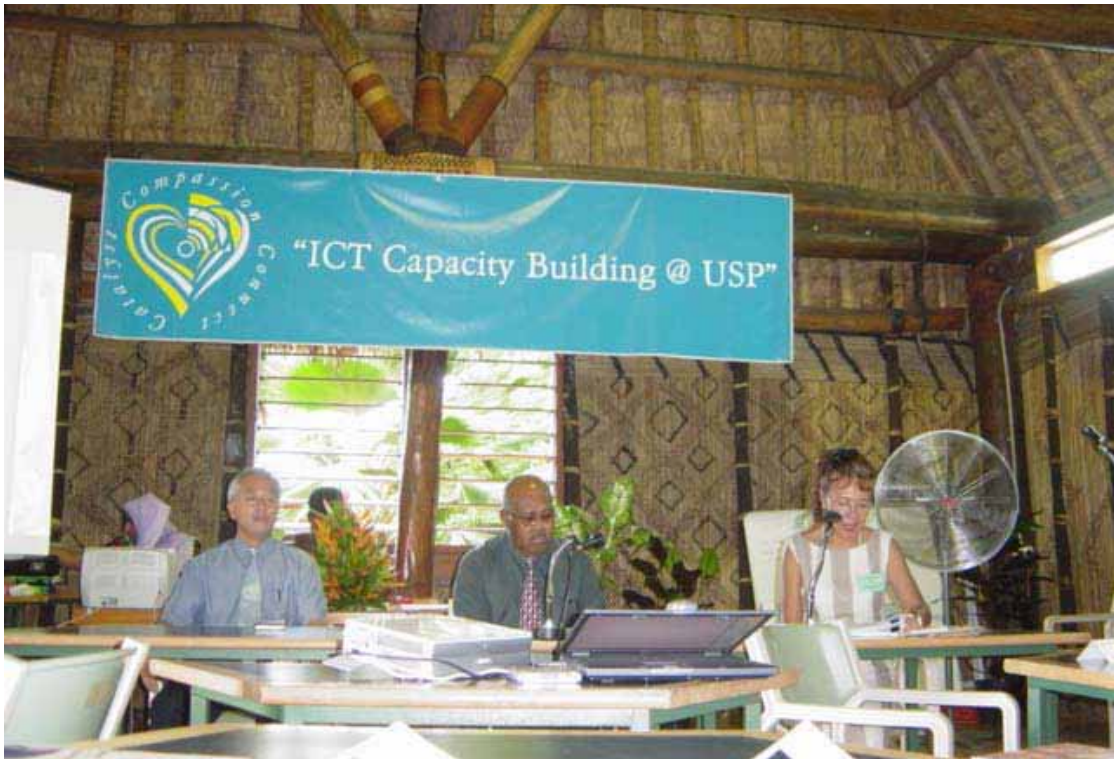
Table 24: Level of specific computer skills required of school-leavers by agencies

Type of Skill	Sufficient Skills	Minimum Skills	No Skills	Not Stated
Computers in general	17 (63%)	1 (4%)	1 (4%)	8 (30%)
Word	13 (48%)	2 (7%)	2 (7%)	10 (37%)
Spreadsheets	12 (44%)	3 (11%)	2 (7%)	10 (37%)
Email	11 (41%)	3 (11%)	3 (11%)	10 (37%)
Databases	9 (33%)	3 (11%)	4 (15%)	11 (41%)
Presentation	8 (30%)	4 (15%)	4 (15%)	11 (41%)
Graphics	7 (26%)	4 (15%)	4(15%)	12 (44%)
Desktop Publishing	7 (26%)	2 (7%)	6 (22%)	12 (44%)
Internet activity	7 (26%)	4 (15%)	5 (19%)	11 (41%)
Webpage development	7 (26%)	1 (4%)	9 (33%)	10 (37%)
Average	**10 (36%)**	**3 (10%)**	**4 (15%)**	**10 (39%)**

(A) Q6: Please rate what level of skills your agency requires from school-leavers in the use of these applications.

Graph 9: Level of specific computer skills required of school-levers by agencies





Chief guests at the CS Symposium

Evaluation of CS/IT curriculum by the agencies

Responding to the question: *Do you think that the present CS curriculum in secondary schools provides good basic training in computer application usage?* 22% of the agencies evaluated the current CS/IT curriculum positively and 37% negatively. The agencies that evaluated it positively include 2 banks, 2 telecommunication companies and an electronic company. Agencies evaluating the current curriculum negatively include the Council of Regional Organizations in the Pacific (CROP), 3 finance companies, 1 radio station, and 4 others. Of those that viewed the curriculum negatively, 26% indicated that it is outdated. One focus group participant puts it lucidly:

> *"The prescription should be changed yearly as this is IT we are dealing with and things change very fast in this sector. My daughter is taking CS in high school and they still teach about magnetic tapes and stuff. I wonder who uses these things nowadays?" Telecom representative*

Graph 10: Percentage of agencies by whether they think the present CS curriculum provides good basic training .

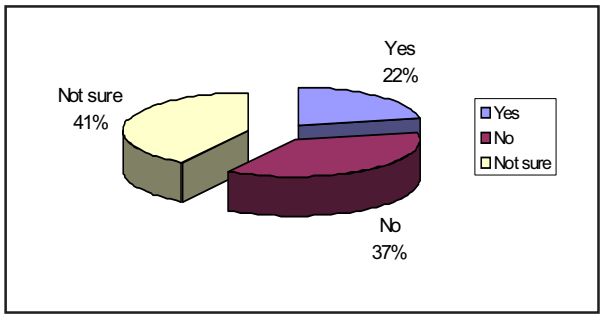


Table 25: Agencies' reasons for saying the present curriculum does not provide good basic training

Reasons for view on the present curriculum	No. (%)
Curriculum not improved to keep up with advances in technology	7 (26%)
Not enough computers in schools	2 (7%)
Too theoretical	2 (7%)
Schools need more qualified teachers	1 (4%)
Total	**12**

Two agencies that responded to Q9 that they were not sure if the present curriculum provided good basic training gave their reasons. This was required for only those who responded 'No' to Q9. Therefore, the total exceeds the 10 who stated 'No' for Q9.

Summary

This research identified many problems in the current CS/IT education. Teachers and students identified the following: the theoretical nature of the CS/IT curriculum, problems relating to the lack of equipment and appropriate PC laboratories and Internet access, high costs of equipment and Internet charges and slow maintenance services. The insecure status of CS/IT teachers, limited opportunity for further education for them and little networking among stakeholders were also highlighted as problems and will be discussed in more detail in Section 3.

From this research we were unable to obtain a good understanding of the agencies' and industries' expectations in terms of skills requirements for a specific job and problems they may have when recruiting people with CS/IT skills. Agencies tend to require of school-leavers that they have basic CS/IT skills, such as familiarity with word processing, spreadsheets and E-mail. However, a more in-depth study might reveal more valuable insights.

In relation to the identification of problems, a number of issues were raised that needed attention. These key concerns were: 1. the urgent need for a CS Curriculum review; 2. a review of the present examination and assessment style; 3. upskilling of teachers' so that they can teach CS/IT more effectively; 4. increasing accessibility to equipment and the Internet for teachers and students; 5. improving maintenance services; 6. introducing more up-to-date software in the curriculum. All these will be discussed in greater detail in the following section.

Teachers and students identified problems relating to the current CS/IT education more critically than the agencies. As the teachers and students are the most crucial groups to be affected by any changes in the CS curriculum, their views should be taken into consideration when plans for revising the curriculum are made.

Left: students in a CS class
Below: a well-equipped CS lab

Section 3: Problem Analysis

Curriculum

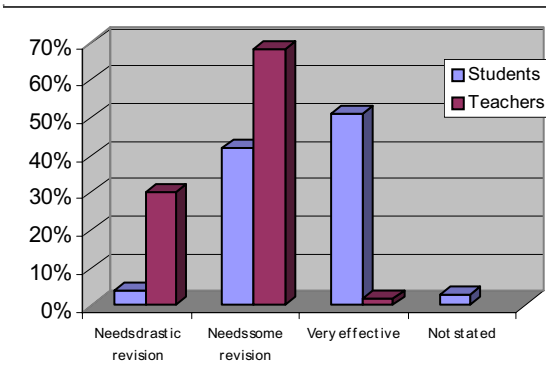
We embarked on an evaluation of the present curriculum from two perspectives: the perspective of the stakeholders (agencies, students and teachers) in the questionnaire and focus group interviews and, secondly, the perspective of the academics involved in education and the ICT area at tertiary institutes. The team wanted to ascertain the major areas for curriculum revision.

Views of students, teachers and agencies

a very high 98% (Table 26) of the teachers and 45% of the students stated that the CS/IT curriculum should be revised. As the teachers and students are the major players in the teaching and the learning fields, their views are critical.

Table 26 and Graph 11: View of the present CS curriculum by teachers and students

	Students	Teachers
Needs drastic revision	9 (4%)	13 (30%)
Needs some revision	91 (42%)	30 (68%)
Very effective	111 (51%)	1 (2%)
Not stated	6 (3%)	
Total	**217**	**44**



Students

Fifty-one per cent of the students stated that CS/IT class is effective. However, in the focus group interview, students were more critical of the curriculum. Most of the students stated that their school taught CS/IT classes from Form 3 but not as an examinable subject, and most of these classes taught theory only. Comparing themselves with students from Suva International Secondary, a private and well-equipped school, they considered themselves as disadvantaged as they only get to learn CS/IT in higher forms. They suggested that CS/IT education should be taught as an examinable subject in all schools from Forms 1 to 3, and from Form 4 upwards the curriculum should be more challenging than it is now.

> *"... the present curriculum should be taught to the lower forms like Forms 1 to 3 and from Form 4 upwards the curriculum should be more challenging and tougher than now." USP Foundation student*

The curriculum was also too theoretical. Students found the CS/IT classes boring as there was too much note taking and very little hands-on practice;

> *"Need to be taught more programs and Pascal, Basic Programming, how to use the Internet, emails and how to search the net." Labasa Sangam*
> *"Boring — too much note taking and the Internet is slow." Yat Sen*

Students stated strongly that they found the history portion of the CS/IT curriculum extremely boring; some students stated that in their schools, history of the computer was taught for over two weeks with a great many notes, reading and self learning.

> *"Yeah, I agree that we need more practical exams. At the moment we have questions like write the commands to open a file, etc. In real life we don't need to know the written commands; we just click on icons so the tests are useless in testing our knowledge. Also take out [computer] history from the present lessons, it's too boring, take out things such as magnetic tapes lessons,*

and teach us about new additions like MPs etc." Labasa Muslim College
"Also [computer] history should be taught for only a few hours maybe. Now it's too long and boring. We only do it to pass exams." Ratu Sukuna Memorial School

The interviews with teachers indicated that although they would like to change the contents, they could not, as teachers had little choice in making changes to the curriculum. Two problems were highlighted, inflexibility and the contents. A few students stated that the CS/IT curriculum was treated as a Bible and that usually the teachers did not want to divert from its outline. The students added that many teachers lacked creativity and a vision to improve the curriculum.

"We told teachers that it is boring, but they said they have to follow the curriculum".
Ratu Sir Lala Sukuna Memorial School

Teachers
Almost all teachers (98%) were using the current curriculum, even through they stated that a drastic revision is needed. In the focus group interviews, teachers explained that it was essential that they followed the curriculum, as the external examinations are based on this curriculum and they could be evaluated based on the pass rate for their classes.

It was realized during the interview that some teachers understood the students' complaints clearly. However, these teachers said that trying to make suggestions for change was hopeless because they had to follow the curriculum. They did realise that at times some junior students who have PCs at home were more computer literate than some senior students taking CS/IT in school. In response to students' complaints that the subject was boring, the teachers responded that the curriculum should concentrate on the practical use of a PC to allow students to become familiar with PCs and make the classes more interesting. The teachers stated that the environment was also a key factor in learning. According to the Form 7 prescription, students have to visit private companies or agencies to see a database for completing their project. One teacher in the focus group mentioned that this was not practical as 90% of the students were not allowed access to private business systems and therefore were not able to complete that section of their project. In the evaluation of the MOE, 30% of total assessment is based on practice; 10% each for word processing and spread sheet; 5% for programming and 5% for other tasks, such as projects.

In essence, the teachers did recognize the need for a review but had to operate and teach within the existing curriculum because of the demands placed on them by the examination system and their own personal assessment as teachers.

Agencies
A participant from an agency in the focus group interview suggested that a drastic change of the curriculum was needed. He suggested that there be separate instructional text books and, as computers are used mostly for practical purposes, teachers should have prior knowledge of computers both in theoretical and practical terms before teaching students. He also reiterated that the prescription should be changed each year, since we are dealing with matters that are changing very fast, a permanent trend in ICT. He emphasised that the MOE should have forward-thinking people in the IT section who would liaise closely with the private sector to obtain user knowledge, and base the CS/IT prescription on this.

Nineteen of the agencies interviewed indicated that they employed recent school-leavers. Nine indicated that they were willing to be part of the CS/IT curriculum evaluation committee. Also, ten agencies stated that they were willing to train teachers as part of industrial attachment. These agencies view this as their possible contribution to society and were seeking added value for their business opportunities. It was apparent that the agencies were concerned about the quality of education that Fiji children were eceiving, and were willing to collaborate with the MOE to review and develop CS/IT curriculum.

Professional view of the curriculum

In Semester 2, 2001, Mr Keesing, USP Lecturer in Computing Science, conducted a small survey of the relationship between achievement in CS/IT in Form 7 and the first year USP course entitled CS122 *Information Systems II* (results sent by email on 19 June, 2003). Approximately 50% of the students enrolled in this course completed the survey. Almost half (117 out of 240) students stated that they had studied CS/IT in secondary school. Their final course marks at USP for CS122 were not significantly different from the marks of those who had not studied CS/IT at school. The mean for students answering "Yes" to studying CS/IT in secondary school was 57.26% and the mean for students answering "No" was 56.56% (Or even close to it, $p<0.4$). It was concluded that there was no difference in performance between students who had studied CS/IT in Form 7 before coming to USP to join degree studies and those who had not. However, there was a significant difference in performance for students who had completed the USP course CS 111 entitled *Introduction to Computing Science* when compared with those who had not, clearly indicating that the "right" programming experience makes a big difference. The means are 66.17% vs. 51.15% ($p < .001$) . CS 111 is the introductory course for CS/IT studies at USP and has no strong relation with CS 122 (see Annex 9 for the course outlines of CS 111 and CS 122).

In his presentation entitled "Towards a New Curriculum"[10] in the Symposium, Mr. Keesing highlighted the problems of new students at USP, particularly those who join USP straight from secondary school. These problems were observed by USP Maths and CS staff. Mr. Keesing surveyed the faculty staff via email for their views on the preparedness of incoming students for CS/IT courses. There was a consensus that:

- programming experience has little effect,
- students struggle in programming courses due to lack of background in:
    - algorithmic thinking
    - problem-solving vs. memorisation
    - specific background knowledge (Base 2, Boolean logic).

Mr Keesing also compared Fiji's current CS/IT Form 7 curriculum to the following curricula:

- 1993 ACM Model High School Curriculum,
- 2002 ACM Model Curriculum for K-12,
- Ontario (Canada) CS & IS (Grade 11 & 12),
- 2003 Advanced Placement Curriculum (US),
- NZQA Sixth Form Certificate – Computer Studies,
- NSW Board of Studies Computing Applications course.

In conclusion, he stated that while other curricula emphasize the importance of computing skills and concepts, the current Fiji Form 7 CS/IT curriculum has the following peculiar characteristics:

- it is more theoretical, less practical;
- it covers many unusual topics that are not covered by other curricula such as Systems A & D, Database management;
- programming is one unit out of total 8 units; (programming is optional, if offered at all, in most similar curricula);
- material on history of computers is atypical;
- there is no coverage of Internet/WWW/email; and
- the program is relatively inflexible.

10. The text of *Towards a New Curriculum* can be obtained online at <www.usp.ac.fj/jica/CS>

Researchers' view of the curriculum

The team undertook an analysis of the CS/IT curriculum in Fiji and Japan (See Annex 10 for overview of the curriculum types). However, this comparison is general as there are huge environmental, economic and cultural differences between these two countries and they have different visions of what kind of country they are seeking to become. This information is purely for reflective purposes at this stage and may not be used in any other context.

The differences between the Japanese and Fiji curricula sre given below.

- Year of establishment: Fiji in 1996 and Japan in 1999.
- Assumption: Students will have had limited opportunities with computers in Fiji while Japan envisions its society with ICTs.
- Objective: Fiji uses the term "Computers" while Japan uses "ICT". ICT[11] has broader definition and application compared to the term computer. The terminology difference gives the impact to the whole design of the curriculum.
- General impression: Fiji's curriculum seems out of date as it still uses old hardware such as magnetic tapes and five inch floppy diskettes, while the Japanese curriculum includes current trends such as ICT security using new technologies, allows students more flexibility and fits into the students' proposed future plans. In addition, in Japan, the focus is more on basic concepts and is more logical and algorithm oriented with a clear focus on practice, while Fiji's curriculum is focused on rote learning and little practical application. There is no history section in the Japanese curriculum.

Since 1996, the ICT situation and environment in Fiji has changed greatly. More students now have computer access as well as Internet access at home. The society in general is showing more interest in CS/IT and the community seems to be getting more involved in the education of their children. Another area of concern for the Fiji curriculum is the lack of up to date teaching materials and resources for both teachers and students. Fiji's education system is exam oriented and teachers and schools are measured by results. Therefore, the teachers stick closely to the MOE CS/IT curriculum with little flexibility and creativity.

Evaluation of the examination

In Fiji, the Seventh Form Examination is a national examination that is sat by all students completing their seventh form studies; a pass in this examination is a requirement for entrance into university studies. In contrast, the equivalent Japanese examination is used as a first test for higher education entrance. In addition, in Japan, each university requires its applicants to sit a different second test. This is because the first test, which is sat nationally, contains only multiple choice questions to test a student's basic knowledge and skills.

In the Fiji Seventh Form CS/IT examination there are attempts to cover all layers of topics, such as system design, application and programming. It gives the impression that all students should have the same level of basic knowledge for future use, even though students are diverse in their career preferences regarding ICT. A review of past examination papers reveals that the examination questions test recall; 90% of the exam questions could be answered by memorization of text, whereas only 20% of the Japanese exam is of a similar nature. In consideration of the limited access to PCs and other equipment and the large class size in Fiji, the extensive teaching of theory can be understood. A more practical content would need better access to essential resources, such as computers and network, which is a problem in Fiji.

11. ICT includes learning about the "technologies of telecommunicatoons, computing and microelectronics and their convegence which has created a range ofnew possibilities for information collection, storage, manipulation, transmission and presentation" (Byron and Galgiardi 1998).

When we examine the results of the Form Seven CS/IT Examination in 2001, we find two points of interest: one, that students do quite well in CS examinations (total pass rate is 74%) compared to English (65%) and Maths (65%); and two, that there is a difference in performance by Fijian and Indo-Fijian students (Annex 2). Of the 120 Fijian students who sat CS, 48% passed, compared to 81% of the total 457 Indo-Fijians.

Comparing the Fijian and Tongan CS Curricula

The plan for examining the Tongan CS curriculum was to make some comparisons with another country in the South Pacific region that offers CS/IT. However, we did not have the opportunity to have interviews with students, teachers and other stakeholders, so our review of the curriculum is not in-depth. It touches largely on the processes and mechanisms of CS/IT curriculum development in Tonga, and is based on interviews with a number of teachers and stakeholders. The curriculum can be found on the website <http://www.tongatapu.net.to/compstud/context/default.htm>.

In interviews, it was noted that Tonga had introduced CS/IT with a number of objectives. These include a focus on the process of continual development and change to the curriculum to reflect new developments in ICT globally; a focus on raising academic standards in this area together with the acquisition of practical skills, flexibility in content and teaching methodology; and more task and practical oriented assessment of the students. It was clear from the interviews that Tonga aimed to produce more technicians than programmers or electronic engineers. This is further confirmed when examining the prescription for CS/IT curriculum.

An examination of the curriculum indicated that the prescription covered some areas in CS that were outdated, namely old hardware and old operations. An emphasis was placed on word-processing, spreadsheets, databases, networking and desktop operations. There was limited emphasis on more logical thinking and an algorithmic approach. In discussing the matter with a number of teachers and officers we found that they recognize the need to change the curriculum to introduce more logical thinking, and to change the focus to include more programming. However, the lack of trained CS/IT teachers and new computers in the schools has meant that the curriculum is designed to give students an understanding of general computer knowledge and develop their competencies in the use of computers. In addition, the lack of an ICT infrastructure and industry has also impacted on the focus of the curriculum.

Those interviewed were committed teachers and keen to see some changes to the curriculum. The flexible processes and mechanisms in place will allow Tonga to push on with its plan to introduce CS/IT into all schools and at all levels. The government recognizes the importance of CS/IT and plans to divert more resources to this area but the number of CS/IT teachers now leaving to join the private sector has created a further problem for the country. Tonga faces a major challenge in this area.

Table 27: How CS/IT students say they are assessed and how teachers say they evaluate their students

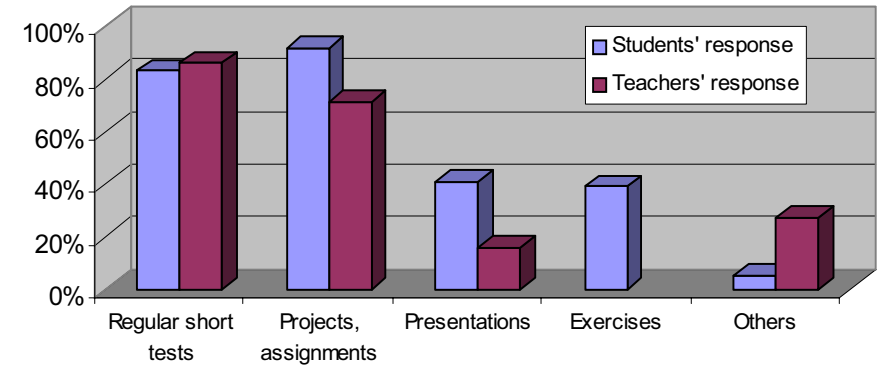
Assessment Methods	Students' response	Teachers' response
Short tests regularly	180 (83%)	38 (86%)
Projects & assignments	200 (92%)	31 (71%)
Presentation	89 (41%)	7 (16%)
Individual exercises	85 (39%)	
Others	11 (5%)	12 (27%)
Total	**217**	**44**

(S) Q 22: How does your teacher assess you for CS? Check all that apply.
(T) Q 42: How do you evaluate your students?

Assessment in Fiji

Teachers indicated that they are using various methods of assessment: short tests, projects, examinations and assignments. In the focus group meeting, students were critical of the way they were being assessed as the assessment method did not test their understanding and use of the technology. They said that they were disappointed that they were not tested on the practical use of the computer itself, especially as this was a CS/IT course. A request for practical assessment was the strong request from students. They also criticized the "Project topics" stating that plagiarism was rampant; they copied projects from their older siblings or friends as the topics are always the same. Students requested fewer essays, more group work and more programming lessons.

Graph 12: How CS/IT students say they are assessed and how teachers say they evaluate their students



(S) Q 22: How does your teacher assess you for CS? Check all that apply.
(T) Q 42: How do you evaluate your students?

Awarding certificates at the CS Symposium

Teachers' status and professional development

Status of CS/IT teachers

As shown in Table 14, 82% of teachers are Grant-in-Aid teachers with salary ranges of $5,000-$6,000 and $16,001–$17,000, as indicated in Table 15. One of the major concerns amongst the CS/IT teachers is job insecurity. The teachers under the Grant-in-Aid scheme who participated in the focus group interviews reiterated their anxiety of being at the mercy of the education officers and the school management. Most of the Grant-in-Aid teachers complained about the late payment of salary every year, particularly at the beginning of the year when they have to wait for 3-4 months to get an approval letter from the IT Section of the Ministry of Education. Teachers felt that they were not given adequate remuneration and treated their temporary appointment as a 'stop gap' job as they were insecure as a Grant-in-Aid teachers. All CS/IT teachers in the focus group interviews agreed that the MOE should send the appointment letters to the Grant-in-Aid teachers much earlier to prevent the feeling of insecurity amongst them. Concerns were also raised that new USP graduates with Education and IT qualifications would replace them as they were not certified teachers, even though they have more teaching experience. The Grant-in-Aid teachers said they have less favorable conditions than the Civil Service teachers. Some teachers stated that, as Grant-in-Aid employees, they were not paid as much as Civil Service teachers and this, combined with the insecurity in their status, makes them apply for other jobs.

According to one school principal, there is a high turnover of CS/IT teachers and full-time positions are given to teachers based on their experience and performance. Additionally, retention of CS/IT teachers is difficult because of better salaries offered by the IT industry. However, our data (Table 14) did not show a strong relationship between the number of years' experience and status. One teacher pointed out that the reason for the unstable status was the lack of teaching experience in CS/IT for in-service teachers. Fifty five per cent of the CS/IT teachers who graduated from USP did not have a CS/IT Teaching Certificate. Only in 2003 did USP commence offering studies in Teacher Certificate with Computing Science majors.

> *Computing Science/Computer Studies is now a teaching subject major in the BEd (Secondary) in-service programme, and the new concurrent 4-year BA/BSc GCED programme for secondary teachers. Students do the Computer Studies courses in the Maths & Computing Science Department, and the teaching methodology in the Department of Education & Psychology*.[12]

Learning opportunities for teachers

Limited learning opportunities were identified as a constraint amongst CS/IT teachers. About 43% (Table 30) of teachers stated that they had attended some workshops/seminars, 32% stated they were part of some committee or study group and 27% said they were taking a university course. However, in the focus group interviews, the majority of the teachers stated they had few training opportunities.

> *No training is provided. MOE staff are always awarded overseas training but we [CS/IT teachers] are never given any training by the MOE. The MOE should give teachers like us at least a few days' training.*

At the same time, some teachers indicated that they were too busy with their workload and family commitments to pursue further studies. In the focus group interview, some teachers stated that if they were to obtain further education on their own, they would enroll for Accounting and other such courses to become more marketable in the private sector. Those presently enrolled for further studies were enrolled, not in CS/IT but in other fields of study. The teachers were concerned that if they spent time and resources on further studies in the CS/IT field but still did not obtain a secure post and increased

12. Confirmed by the Department of Education and Psychology at USP (2003).

salary, then their attempts would have been in vain. If teachers were given sponsorship opportunities, these teachers would be keen to study further in the CS/IT related fields. Teachers also mentioned that their school principal did not usually encourage them to attend workshops/training, and any such attendance was commonly granted as annual leave.

About 85% (Table 28a) of the teachers stated that they would prefer a flexible (including on-line course) mode of learning while working and 20% preferred intensive courses of a few weeks or months.

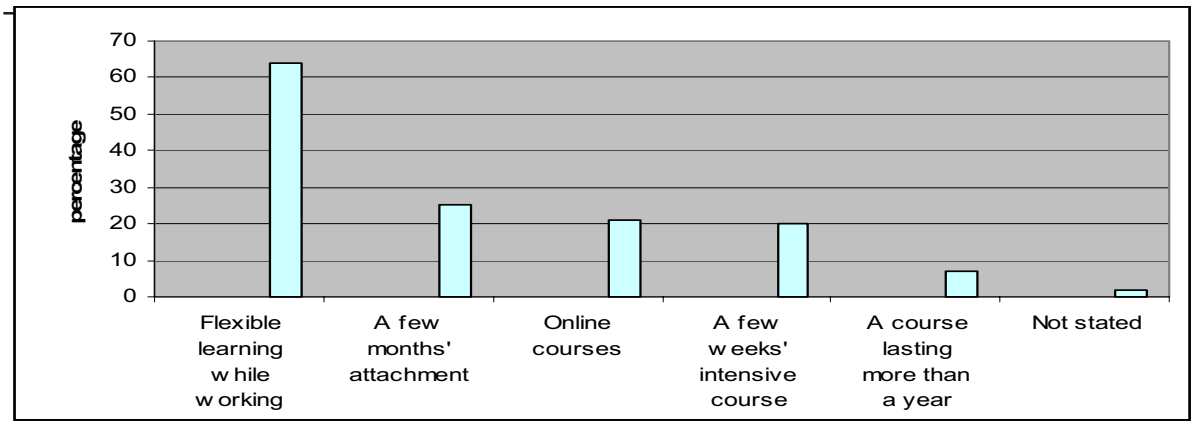
Table 28a: Teachers' participation in developmental activity in the past year

Developmental Activity	Yes	No	Not stated
Workshops/Seminars	19 (43%)	23 (52%)	2 (5%)
Committees	14 (32%)	28 (64%)	2 (5%)
Study Groups	14 (32%)	28 (64%)	2 (5%)
Course by Tertiary Institutions	12 (27%)	31 (71%)	1 (2%)
Teachers' Clubs	9 (21%)	33 (75%)	2 (5%)
Conferences	4 (9%)	38 (86%)	2 (5%)
Internships	4 (9%)	38 (86%)	2 (5%)
Teacher Resource Centre	4 (9%)	39 (89%)	1 (2%)
Others	3 (7%)	39 (89%)	2 (5%)

Q8: In the past year did you participate in any of the following types of professional development activities related to technology? (Multiple responses).

Table 28b and Graph 13: Preferred mode of learning

Flexible learning while working	28 (64%)
A few months' attachment	11 (25%)
Online courses	9 (21%)
A few weeks' intensive course	9 (20%)
A course lasting more than a year.	3 (7%)
Not stated	1 (2%)



Q11: In what mode of teaching would you prefer to learn the above? (Referring to the 10 CS topic options listed in Q9, multiple responses).

Teacher training

A low 39% of the teachers stated that they had been trained to teach CS/IT but only 14 of these 17 teachers (Table 29a) named the institution where they had trained. In the focus group interview, two teachers said that they had already enrolled for a Teacher Certificate course and hoped to become Civil Service teachers upon completion of this course. However, they found it required a lot of essay writing and other assignments which they found boring. There was limited practical application in the training.

Of the teachers who did not have any formal teaching qualifications, 98% stated they used the MOE prescription and other reference books to teach CS/IT, and that they had on-the-job training. In the focus group interview, teachers stated that they learnt mostly by themselves and through books. It was assumed that they had gained experience to teach but without any basic discipline of teaching. Some teachers were aware that USP would offer the courses for teaching qualification, and were concerned that new USP graduates with teaching qualifications would be recruited as Civil Service teachers ahead of them, and they could be terminated even though they had more teaching experience.

Table 29a: Where were you trained to teach CS?

USP	5 (29%)
FIT	5 (29%)
STTC	1 (6%)
NRC	1 (6%)
FSAE	1 (6%)
NZPTC	1 (6%
Not stated	3 (18%)
Total	**17 (100%)**

Table 29b: If you have not been trained to teach CS, how do you manage to teach?

Use reference books, MOE's prescription	19 (70%)
Get assistance from other teachers	9 (33%)
Through experience over the years	5 (19%)
Not stated	4 (15%)
Total	**27**

(Multiple responses)

Above: Participants at the CS Symposiom

Left: Mr Tomobo and Mr Turaganivalu at the CS Symosium

Accessibility of CS/IT education

In 2002, 86 of the 156 secondary schools in Fiji offered CS/IT education (Annex 5). Table 30 shows that 75% of all the secondary schools in Fiji are connected to Fiji Electricity Authority power and Annex 5 shows that 35 (41%) of these 86 schools have Internet access. Twenty (57%) of all 35 schools with Internet access are in the Central Division within the larger Suva-Nausori vicinity. This access is illustrated geographically in Annex 4, which shows that almost half of the Vitilevu schools teaching CS/IT have Internet access, particularly schools in the Suva-Nasinu-Nausori corridor. Overall, schools teaching CS/IT are concentrated in town areas like Suva, Nasinu, Nausori, Lautoka, Ba and Labasa. Many schools outside the town areas and in small islands do not benefit from Internet access as they do not have telephone connections.

In the focus group interview, it was found that some schools in Suva provide free Internet access for their students, and encourage students to obtain online resources for projects and assignments. However, in many other schools with Internet access, access is strictly controlled and usually available only to teachers. Students have to pay a fee for the use of the Internet and a printer and other such equipment. On the other hand, all the students from the western and northern schools who participated in the focus group interviews indicated that they did not have Internet access at all in their homes. They did not have Internet access in their schools either, not even paid access. There was consensus amongst all respondents ¯ students, teachers and stakeholders ¯ that the high charges hinder access to the Internet and those schools that did have access noted their frustration at the slow speed of access.

> *"The Internet charges in Fiji are currently too much. Not everyone can afford to pay up to 11 cents per minute now. Probably that's why most of the schools do not provide the students with free Internet services." Mahatma Gandhi Memorial School*

Table 30: Secondary schools with access to electricity

Source of electricity	No. of Schools	Percentage
Fiji Electricity Authority (FEA)	117	75%
Generator	37	24%
Solar	2	1%
Total	**156**	**100%**

Source: Ministry of Education Statistics

Equipment for schools that offer CS/IT education

Many schools (81%) have 10-25 computers (Table 31a) while one school has 95. Table 31b shows that 76% of all the schools in the survey have between 10 and 25 computers for their students and 12% of the schools had 35 and more computers for students. The Implementing Guidelines of the MOE Computer Studies Prescription, section 4.0 Ratio of Students per Machine (see Annex 12) states: "*The maximum number of students per machine in a computer class is two (2). This ratio is necessary to insure that students have sufficient time to interact with the computer."* 67% of the schools interviewed indicated that the two students per PC guideline was followed, 17% of the schools interviewed had one PC per student, and 12% had more than two students per PC. Table 26 shows that the greatest barrier to learning and teaching CS/IT is "lack of PCs" but 67% of the schools achieved the 2 students per PC ratio. However, one CS/IT teacher explained that this high access is due to distributing students and sharing computers for practical classes in such a way as to give most students access to PCs.

Some computers are relatively old but still capable of being used to teach basic computing skills. 75% of the schools have at least 5 computers for teachers' use, and 50% of the teachers stated that they use a computer to type assignments, 9% use it to play games, while only 18.5% use it to prepare for CS/ lessons.

Table 31a: Total number of computers in schools

No. of PCs	No. of Schools	% of Schools
5	2	5%
10	7	17%
15	11	26%
20	3	7%
25	13	31%
30	1	2%
35	1	2%
40	2	5%
45	1	2%
50	1	2%
55	1	2%
95	1	2%
Total	**42**	**100%**

(T) Q30: How many usable computers does your school own? (Include portable computers and laptops.)
Note: The total is 42 as in two schools more than one CS teacher filled in the questionnaire.

Table 31b: Total number of PCs available for students

No. of PCs for Students	No. of Schools	% of Schools allowing students to access PCs
0	1	2%
3	1	2%
5	4	10%
8	1	2%
10	13	31%
15	5	12%
20	10	24%
25	4	10%
35	1	2%
40	1	2%
45	2	5%
75	1	2%
Total	**42**	**100%**

Table 32: Main purpose of computer use by teachers

Main purpose of PC use	
Typing assignments	22 (50%)
Preparing computer lessons	8 (19%)
Learning more	8 (18%)
Internet access	5 (11%)
Playing games	4 (9%)
Making work easier and faster	1 (2%)
Programming	1 (2%)

(T) Q29: What is your main purpose of computer use? (Multiple responses, so the total exceeds 100%.)

Right: Ratu Kadavulevu School computer lab

Left: Limites facilities in a lab, a common sight in many schools

Right: PCs out of order, another common sight

Summary

Students, teachers and stakeholders, including USP lecturers and other professionals in the IT industry, reiterated the urgent need for a change in the curriculum. Generally, it was recommended that the new curriculum should:

- be oriented more toward logical thinking and algorithms;
- be more up to date with terminology;
- be more balanced with practice and theory;
- be more flexible so that it prepares students for various options in the job market or further study;
- have an effective assessment procedure.

Students found the present CS/IT curriculum boring. Teachers agreed with the students, but they were bound by the strong link between curriculum and external examination and so continue teaching the MOE prescription. Furthermore, a USP academic in his comparative analysis of CS curricula, concluded that, while a CS curriculum should emphasize the importance of computing skills and concepts, the Fiji curriculum was not practical enough, used outdated programming language and had no coverage of the Internet. Students were assessed internally and externally. The internal assessment style of the CS/IT curriculum left room for plagiarism, while the external assessment focused more on rote learning and did not assess students' knowledge of the use of technology.

In the focus group interviews, many students judged their teachers as very helpful. Others, however, judged them as being too bookish and needing practical training. Teachers wanted to obtain further training opportunities, particularly in Education and CS/IT courses, in order to secure their post and learn the latest technology. Two thirds of the teachers interviewed had learnt to teach CS on their own and 85% of all the teachers wanted to learn online, if opportunities were available.

Accessibility to IT education for the less affluent schools, Internet access and equipment were also major concerns. Although the MOE standard of two students per PC was achieved in most of the schools, many of the computers were old or were not functional. While the Internet was available in 41% of the CS/IT teaching schools, in the focus group interviews, it was found that many schools strictly control Internet use by students, and in most cases only teachers were allowed access.

Participants of the CS Symposium

Section 4: Best Practice

In this research we utilized the 'best practice' method to learn, highlight and share opportunities of leverage to improve upon what has been done before. While each combination of teachers, students and classrooms is different, it is important to take into account relevant work done by others that is considered best practice. A best practice case would usually offer the following:

1. compelling stories from schools or educators;
2. fresh insights into problems;
3. new ideas to try that may work in your setting;
4. tips for success in applying existing ideas;
5. pitfalls to avoid;
6. examples of success in action that can be communicated;
7. explanations for why things worked (or did not); and
8. resources, funding and partnership opportunities.

Identification of best practice cases

Two schools were identified as best practice cases after the research team learned about them from teachers and students during the various focus group interviews and other informal discussions before and after the questionnaire interviews. Nadi Muslim College was singled out for its impressive facilities and system while Labasa Sangam College was singled out in respect of its proactive role in promoting CS/IT education in the local community (Labasa). The CS/IT teachers from these two schools were invited to speak at the symposium to enlighten the participants on their activities relating to CS/IT learning and teaching. Discussions focused on the role of the principal and management of these schools. To collect more in-depth information, the researchers visited the schools and held informal discussions with the management and principals.

Interview Results
Overview

Items	Nadi Muslim College	Labasa Sangam College
Location	Within Nadi town area	Within Labasa town area
Number of students	Approximately: 1200 students Gender ratio: female 60; male 40; Ethnicity ratio: Indo-Fijian 70: Fijian 30	Approximately: 1100 students Gender ratio: female 65: male 35; Ethnicity ratio: Indo-Fijian 60: Fijian 40
Number of teachers in CS/IT	Five (four in early 20s) Only Head of Department, with 6 years experience, is a Civil Service teacher. Others are Grant-in-Aid.	Four (three in early 20s) Only Head of Department, with 12 years experience, is a temporary Civil Service teacher. Others are Grant-in-Aid.
Proactive developments worthy of mention	A school reform project was undertaken to increase the roll and pass rate of students. This resulted in an increase to 1200 students in 2003, from 400 in 1997, a threefold increase. During the same period, the Fiji School Leaving Certificate pass rate increased to 95% from 41% in 1997. Implemented a digital school management system that was developed by the school. Have a "Smart School" vision and plan (attached as Annex 7).	n/a

Items	**Nadi Muslim College**	**Labasa Sangam College**
CS/ICT facilities	PC: around 100. Furniture, machines, and cabling donated by donor originally from Fiji and running a computer company overseas. Students have Internet access.	PC: around 50. Equipped by school management. Have not networked the equipment yet but are planning to do so. Students cannot use the Internet because of former misuse by a teacher.
Initiative	Instigated by school led by principal: *"The donor only assisted us because we had already started." "No donor would want to help you if you don't help yourself." "In some schools, there are computers on very neat tables covered with a piece of cloth and nobody is allowed to use it."*	Management initiated the fundraising to obtain facilities. *"I give credit to the Manager".*
Proactive developments worthy of mention	Offering Short CS/IT course for community: A course for the business sector; A 3-week basic computer course for teachers in a neighbouring school. *"The attendance was very good and all the teachers learned the basics of computers and we charged them nothing."*	A CS/IT teacher started a Computer Club for all CS/IT teachers in Labasa to: share knowledge and information, such as examination papers; submit a letter to the MOE to change the curriculum, etc.
Role of principal	Liaises amongst school management, staff and students.	Encourages CS/IT education and counsels students about not misusing facilities.
Key factors of success	Dedicated principal, teachers, management and donors, and also partnership.	Dedicated principal and school management.
Time management	Initiated more intensive teaching so eliminated note-taking and encouraged more interaction between students and teachers.	Notes are photo-copied for students so they spend less time writing during class. This encourages more discussion in class.
Community involvement	Initially the school was pressured by parents for evening class, and now they are involved in most other activities. *"People know that Nadi Muslim College has got the system and is giving our children the best."*	Community is very supportive. "The parents are highly impressed with computer education".
Vision	Expand target from Form 7 and increase classes for adult education.	Expand target before Form 5.
Education for lower grades, such as Forms 3 and 4	Offering evening classes to give basic computer skills and knowledge. *"By the time they come to Form 5 they are in a position to use a computer to do assignments and online research even if they don't want to take computer studies in higher forms."*	The plan to teach lower forms is still in a visionary stage. *"I hope in years to come to give computer education to every student".*

Items	Nadi Muslim College	Labasa Sangam College
Issues and concerns	Maintenance and cost to repair the machines. *"To maintain the system the cost can be a problem"* but *"teachers are learning how to repair PCs."*	Demand with limited resources. *"More students want to take computer classes but we have to keep the number down." "We need more equipment but don't have it because of some financial difficulties."*
Refreshing training for teachers	Teachers are trained by donor to be computer literate.	Question of very few training courses and workshops for CS/IT teachers. *"Very few. None. I don't think I have ever sent my staff for any training whereas in the other areas there are lots of workshops and other things." "If there are any computer workshops I will be very happy to send our teachers."*

Principals' views

Items	Nadi Muslim College	Labasa Sangam College
Learning of *CS/IT*	Self-learner with interest. *"We, some of the older guys in the school, were told that we would come last in this area. And that's exactly what happened but the younger teachers were faster."* However, *"If you have an interest, you will learn".*	*"Frankly speaking, I do not have much computer knowledge but I am very eager to learn".*
Reason for encouraging CS/IT education	Because it is a marketable skill. *"Every industry is turning to computers" "If you know computer science it is very easy to moving towards it." "You cannot only target the Fiji market".*	In order to adjust to the computerized society and to get better job opportunities. *"After becoming computer literate they are able to keep pace with this fast moving world." "In other countries, everything is computerized." "In Vanua Levu, there are some families disadvantaged in terms of finance and I believe that if their children have some computer knowledge they will be able to get better jobs."*

A well-equipped Labasa Sangam College CS lab

Nadi Muslim College CS lab

Analysis

Key factors for success
Some identified key factors are:

- leadership and support of school principal and management;
- dedicated CS/IT teachers, and
- initiative coming from the institution followed by planning and action. In the case of Nadi Muslim College, we could say that they were lucky to have a wealthy donor. However, we have to keep in mind that the school had planned for this project and then applied for funding for it.

"I think management plays a very important role." – Teacher, Labasa Sangam College
"I think the important factor is that we have good computer teachers." – Principal, Labasa Sangam College
"You cannot build a system in a year. When we start ed off we never thought that Mr Khan was going to assist us." Principal, Nadi Muslim College

It should also be noted that implementing an ICT project in schools where the management and principals are not technology literate would be very challenging. However, in these two schools, they managed to convince their principal and management of the long-term benefits of implementing such projects and, on achieving the desired results, they were encouraged to invest more time and finance into these projects. As one principal stated:

"They (other principals who do not tackle CS/IT education) can't hide for too long. You have to get into it." – Principal, Nadi Muslim College

Learning ICT knowledge and skills
Both principals said that they were self-learners of ICT knowledge and skills. They pointed out the importance of challenge. They also mentioned the dynamics of the ICTs and the importance of refreshing knowledge and skills of teachers. When the Project offered a training course opportunity through JICA, a teacher from Nadi Muslim was so motivated that he arranged all procedures, which would normally take more than a week, in only one day.

"Now that we have learnt it seems easy for us but in the initial stage we didn't know what was happening. It's like being thrown in an open sea and told to swim." - teacher, Nadi Muslim College

New approaches in teaching
Both schools prioritised interactive teaching instead of asking students to copy notes written on the blackboard during class. With the use of new and creative technology such as the Internet and some creative media, the teachers are finding that their roles are changing from knowledge-provider only to facilitator as well.

Community support and vision
The schools stated that their communities were quite supportive, even though the principal of Nadi Muslim College indicated that he had been pressured by parents to move into CS/IT studies. Both these schools opened the computer lab for evening classes and Nadi Muslim College offered a course for Form 3 students in the evening. They also offered short, intensive courses for communities, including industry personnel and staff of other schools. Both have a vision ¯ to expand the target audience and beneficiaries of CS/IT education in the future. Nadi Muslim College will target adult education after Form 7 and Labasa Sangam will target students in the lower grades such as Form 3.

Initiatives

These two schools were not particularly well known in Fiji. However, with their current computer education, they have become important schools in the areas they serve and this achievement in CS/IT education has also flowed to other activities such as sports. This trend has been reported in other countries too.[13]

> *"Students don't have to go to Lautoka and get fatigued during the long commuting every day. We are active in sports and others activities, too. They have a computer club here. The idea came from the teachers themselves and when I asked what the computer club was going to do they said that they were going to mount evening classes, competitions and all that so the interest is being generated in the whole school environment." – Principal, Nadi Muslim College*

> *"I have seen that children have also changed mentally and physically. We have noticed that the students who take Computer Studies are mostly the ones who are ready to participate in other internally organized functions." Principal, Labasa Sangam College*

However, it is too simple to say that CS/IT education has a positive impact on the whole education of a student or improves students' attitude in the schools. We could, however, say that the energy and active atmosphere in the school have led to a successful computer education and other achievements.

Financial management

ICT education is costly, not just the initial investment but also maintenance and relevant training. Nadi Muslim College has a donor and Labasa Sangam has management to support CS/IT education, including provision of computer lab facilities. Neither of these schools increased school fees or charged extra for CS/IT education However, they raised concerns about finance.

The principal and CS teacher of Labasa Sangam College

13. In a number of countries, studies have shown that the use of ICT in the curriculum and CS/IT studies have decreased drop-out rates, recorded achievement gains in the initial stages, improved interest and competence of teachers, and improved student/teacher relations, even though this is still at an anecdotal level.
The Malaysian smart school: The story so far. <http://www.mdc.com.my;Kaewsaiha,Thailand-http://www.unesco.org/bangkok/education/ict/ict-enabling/ap_policy/Learntec-Tongyoo.pdf.>

Summary

Nadi Muslim College (NMC) and Labasa Sangam College (LSC) were identified as best practice cases and they provided the research team with opportunities for observation and discussion so that the researchers could learn from their success stories. NMC had impressive facilities and system, while LSC played a proactive role in Labasa in promoting CS/ICT education in schools and the community.

Key factors of success were identified as 1) leadership and support of the principal and school management, 2) dedicated CS/IT teachers, 3) initiative, 4) finance. The principal and the school management played a very important role in initiating IT education, fundraising for the purchase of resources and encouraging their staff. Both schools indicated the use of technology as a teaching aid, and they had the support of the community and plans to offer IT education to the lower forms and adults. A combination of the above four factors is needed to bring success to any school that wishes to introduce CS/IT and to sustain the program. Initiative was seen as one of the major factors leading to success in these two schools. Despite the success, both schools raised their concerns regarding finance, particularly in relation to the maintenance of equipment and provision of relevant training for the teachers. Neither of these schools is affluent but achieved prominence due to their overall good results in examinations. The principals attributed this achievement to their strong use of IT in education as well as to approaches to CS/IT curriculum.

Nadi Muslim College server

DISCUSSION

This research commenced in December 2002 and was completed in August 2003. During this period, the team had the opportunity to discuss many of the issues regarding CS/IT education with students, teachers and stakeholders individually, in groups and in a symposium. A peer group evaluation of the draft report was also conducted. A discussion of the issues raised is given below followed by 'lessons learnt' and recommendations. (Recommendations from the symposium are attached as Annex 8.)

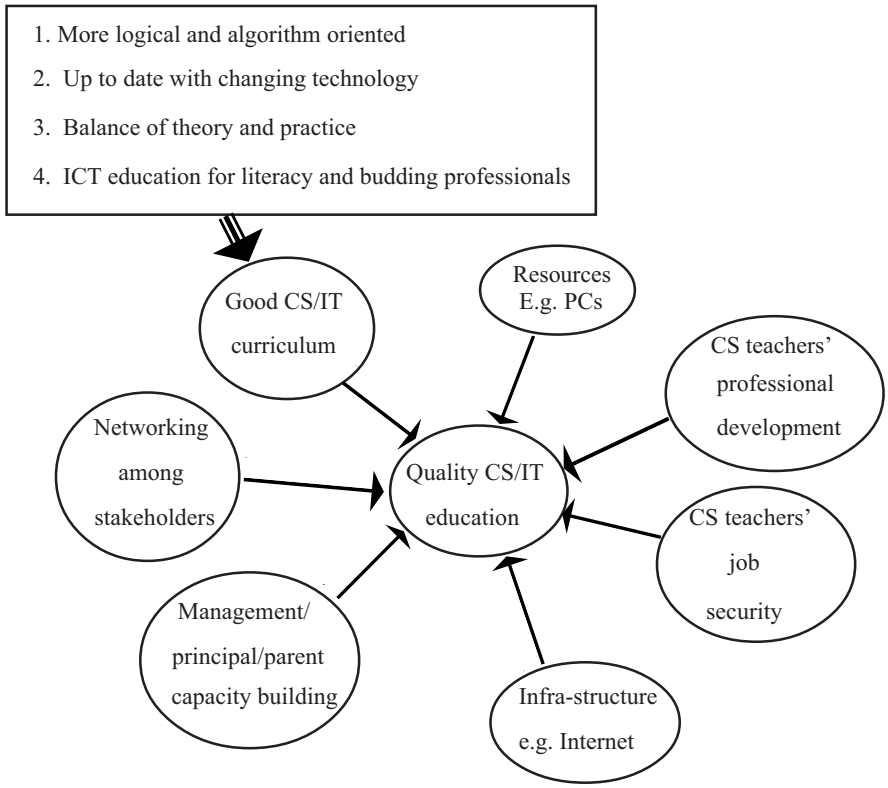
Running through the discussions was the desire to see a review of the present CS/IT curriculum as well as to put in place processes and mechanisms that would allow efficient continuous improvement. It was apparent from the discussions that this revised curriculum should reflect the new and changing trends in CS developments and training, as well as the needs of the market place, the workforce and Fiji's plan or vision for ICT in the future. This would be in line with Fiji's Strategic Development Plan (2002:90–91) where the objective is to align Fiji's ICT training to developments in the employment market, producing trained people with basic generic CS/IT skills and a cadre of trained technicians, engineers and programmers.[14] There was also a call to be mindful of the available technology, resources and improved infrastructure, including Internet in schools, if CS/IT was to be introduced in all schools, particularly rural and remote schools. In addition, a number of human resources development issues would need to be addressed. These include teacher education, job security, teacher networking, and capacity building in the CS/TVET section in the MOE.

It was clear from the discussions and findings that if Fiji is to work towards having a quality CS/IT curriculum, these issues will all have to be addressed as a whole. In other words, a more holistic approach to CS/IT curriculum development is needed. The central idea about how these changes may be undertaken is represented in Figure 1. This illustrates the inter-relating nature of CS/IT studies. In order to improve the CS/IT curriculum, improvement in each of the many inter-relating areas is necessary. In this research, we identified the following areas: resources, infrastructure, CS teachers' job security, CS teachers' professional development and training, management (including principal and parent capacity building), networking among stakeholders and quality CS/IT.

Participants during a discussion session

14. An additional ten schools per year with Internet access and computers, upgrade teachers' skills, IT employment skills training modules adopted by IT training providers.

Figure 1: A holistic approach toCS/IT curriculum revision



In the discussion that follows, these areas have been grouped into four categories: resources and infrastructure (equipment, Internet, educational materials), human resources (CS teachers' job security, professional development and training), capacity building (management, schools and parents) and curriculum (quality CS/IT curriculum).

In the area of resources and infrastructure, this research found that there is generally:

- a lack of equipment and computers;
- a lack of educational materials, such as those available on CD-ROMs and related textbooks;
- poor maintenance and uncertain sustainability of equipment;
- an increased access to the Internet, but the divide still exists.

The essential points that we would like to convey are that to teach CS/IT well and develop high quality curriculum, the equipment and infrastructure problems noted above need to be addressed urgently. In those schools that do not have sufficient computers, every effort will have to be made to supply these schools with computers and the necessary equipment. Financial resources will have to be identified to purchase educational materials and related textbooks.

In the area of human resources, particularly teachers, we identified the following problems:

- low number of teachers that have a teaching certificate and fewer still have qualifications to teach CS/IT;
- high number of Grant-in-Aid teachers;
- a lack of training opportunities for CS/IT teachers;
- a lack of professional support in TVET, MOE due to staff shortages;
- poor job security for Grant-in-Aid teachers;

We also identified the need for teachers' professional development and upskilling. Many of the teachers interviewed highlighted their lack of skills in the CS area as a factor that needed urgent attention. Many would like to undertake more formal and short-term training but opportunities were scarce.

The essential point we wish to make here is that teachers are and will be important in the whole curriculum review process, as they contribute to learning as well as to curriculum development. Ultimately, it is to them that we must return. We believe that they play a critical role in the classroom and help set the standards through their experiences. It follows, therefore, that to establish and build a good quality curriculum, we need to expand our CS/IT teaching force and enrich our teachers.

In the area of capacity building for management, principals and parents, we identified the following:

- that community support is a key factor in best practice;
- that if management sees CS/IT education as critical, they support it strongly;
- that parents also play a key role in encouraging students; and
- that if a school offers a CS/IT course to the community, they might forge strong limks with that community.

While these problems and needs may be relevant for other curriculum review processes, for CS/IT the concern is one of providing a framework that will allow for continuous innovation and review to reflect the changing IT environment. It can be argued that parents and school committee members will need to be regularly informed and updated of the importance of CS/IT studies and the additional resources that may be required. Their help and support will also be needed to push CS/IT studies in schools.

Developing a new, revised good CS/IT curriculum will need the input of stakeholders, as it can be argued that the stakeholders, particularly the market and businesses, will set the type of school leavers and graduates that they may need in the workforce. Regular communication between the stakeholders and TVET, MOE, teachers, schools and tertiary institutions will be important in the review process.

It is suggested that any revision of the curriculum will require wider consultation between the different players and stakeholders, including the agencies, teachers, teachers' associations, tertiary institutions and teachers' colleges, community leaders, school managers and students. The MOE will need to work with these different stakeholders in any plans to develop a good CS/IT curriculum.

Participants during a group discussion

LESSONS LEARNT

Many lessons were learnt from this research and we include some of them here as we feel that they are important to our understanding of CS/IT education in Fiji.

The first lesson we learnt is that it is important to listen to the voices of the people. Through interviews and questionnaires, focus group interviews and discussions with different groups and stakeholders, new insights can be gained. In this research, the breadth and depth of information provided was useful and down-to-earth, with people giving personal experiences and explanations of the current CS/IT education situation and ICT environment in Fiji that cannot be found in any textbook or documentation. This method of acquiring qualitative data is effective and gives a good understanding of the CS/IT situation in the country.

We also learnt of the different attitudes that exist among the stakeholders regarding the digital environment and CS/IT education in Fiji. The children were all keen to learn more and study IT in schools. They were generally excited about the developments in this area and many were very up-to-date with IT. We learnt that many teachers were frustrated, either because of their insecure job status or because of lack of training opportunities in the area of IT. We found that some academics in tertiary institutions and a number of school principals were not very keen on IT developments and the emphasis that is being given to CS/IT education. More time was placed on concerns for problems that existed including the issue of the digital divide within the country rather than acknowledging the advantages and opportunities that the new technologies bring and finding ways to make things happen. However, in some tertiary institutions and schools, academics and principals placed emphasis on the possible way forward in CS/IT and the need for action to be taken to understand how students perform in CS/IT. There was general support to introduce CS/IT widely in schools, both primary and secondary.

Regarding the state of technology in Fiji, we know that this is changing very rapidly, and learnt that, increasingly, we have to move with the flow and acquire new knowledge and skills almost daily. Against this development, we have to make sure that teachers have greater awareness and in-depth knowledge of CS/IT education. Many tend to dwell too much on constraints and difficulties of new technology rather than on solutions.

A significant lesson was to learn what is possible and how to get some action moving. It was evident in our discussions with MOE officials and management that they strongly supported IT education and saw the potential of new technologies in taking schooling to rural areas and expanding access to educational materials through the Internet. Yet, any review of the CS/IT curriculum and the implementation of a revised curriculum will not happen quickly, as the MOE has to follow through a process which may take twelve months. For CS/IT, this is a long process as changes are happening daily in the field of IT.

While it is is necessary to focus our own internal national processes in CS/IT education and curriculum, a lesson we learnt is that it is useful to also look at other countries for new ideas. We looked briefly at CS/IT education in Japan, the United States and Tonga, but there are many other examples we could look at that can help Fiji's case, particularly when it puts together its strategic master plan for CS/IT education.

RECOMMENDATIONS

We have drawn attention to the problems and limitations faced when offering and teaching CS/IT in schools in Fiji. We have also highlighted the need for a review of the CS/IT curriculum. We have learnt many lessons. Our research evidence suggests that, to offer good quality IT education, a sequence of activity starting with the 'big picture' and moving through short-and mid-term phases is needed.

To offer quality IT education in secondary schools, this report recommends the following, categorised for short- and mid-term action;

Short-term recommendations (less than 3 years)

Recommendation 1 – Curriculum Revision

We analysed the current curriculum based on the opinions of teachers, students, agencies and professionals. The majority of them agreed that the current curriculum needs to be revised as a matter of great urgency due to the fast-changing nature of ICTs. The curriculum should reflect this dynamic progress of technology and the accessibility of resources among students due to differences in their socio-economic background.

During the study, it was found that some teachers did not have the prescription, so placing it online is an alternative to make it transparent and accessible for teachers. However, half of the schools still do not have access to the Internet so the prescription could be made available on CD-ROM.
The current procedure of curriculum revision was noted to be too long and suggestions were made to critically review this process to become active and effective. The process may need to be speeded up to some degree to enable more innovation and new ideas to be incorporated into the revised curriculum.

We recommend:

1.1 That the IT curriculum prescription be revised as soon as possible;

1.2 That the IT curriculum prescription be revised to become more:

- oriented towards logical thinking and algorithms;
- up to date with changing technology;
- balanced with practice and theory;
- flexible depending on students' future plans and providing options, such as two streams; one offered to students for ICT literacy and one for students who are interested in a professional career in ICT;
- effective in assessment style with less focus on rote learning.

1.3 That the National Curriculum Review Committee becomes more proactive and organized, and hosts regular meetings with personnel from higher education and the private sector.

1.4 That processes and mechanisms be put in place to allow regular review and changes to the content of the new curriculum.

1.5 That the prescription be made accessible on-line and on CD-ROM.

Recommendation 2 – Capacity Building – TVET, MOE

Considering the current capacity of the MOE's TVET section, which is responsible for CS education, we recommend the following short-term plans for ICT in education.

IT education should be given higher priority, considering national and regional strategies.[15] At present, there is only one officer in charge of CS/IT education at the MOE. There should be more staff to improve the quality of CS/IT education, working in conjunction with USP and other tertiary institutions.

The officer in TVET did not have Internet access. Internet access at the MOE is limited to certain senior officers. However, it is almost impossible to formalise meaningful use of the Internet at school if the Education Officers are not allowed to explore the Internet for effective use themselves in order to help them in their management roles.

We recommend:

2.1 That the MOE increase the number of staff in the TVET section.

2.2 That the MOE provide staff in the TVET section with Internet access.

2.3 That the MOE strengthen the TVET section to undertake a monitoring and evaluating role to continually monitor teachers, all students' performance and progress, and progress in CS/IT in schools.

Recommendation 3 – Universal access to CS/IT studies

This research targets only those secondary schools offering CS/IT education, which is almost half of all secondary schools in Fiji. Accessibility of CS/IT education was highlighted as critical. In order to achieve universal access to CS/IT education in all secondary schools in the near future, we recommend creating a master plan with a feasible action plan and supporting implementation plan.

This study provides a suggested action plan for CS/IT education in Fiji. We have learnt from this and other projects, that the provision of a practical and achievable master and action plan with a logical development framework identifying possible risks is necessary to get work more focused, moving, monitored and productive, achieving the set outputs in the agreed timelines. This will be a major task for TVET, MOE.

In this research, we targeted secondary schools only, as the current curriculum is for Forms 5 to 7. About 20 schools, however, have started teaching IT in Form 1. In our interviews, students requested that IT education be started in lower grades and made compulsory. We therefore recommend having a future plan which will include IT in lower grades in all schools.

Only 86 of the total 854 schools in Fiji offer CS/IT studies. These are all secondary schools. Under Fiji Government's Strategic Development Plan 2003 – 2005, CS/IT studies will be introduced in 10 schools each year over the next 5 years.[16] This means that by 2009 only 136 schools will have CS/IT studies. This is not very good progress, considering the rate of rapid change taking place in IT developments worldwide and locally. It can be argued that in Fiji many of the schools in the rural and remote areas are disadvantaged in that they face many barriers of access to new technologies and will continue to rely on texts and handouts for learning for some time. The MOE and GoF will have to review and step up plans to introduce CS/IT studies in remote and rural schools and this will mean that more CS/IT teachers, resources, computers and laboratories will be needed.

15 and 16. There is a draft ICT National Policy and a paper entitled *e_fiji.* In these documents, ICT is given priority in national development with goals to get CS/IT curriculum in all schools, all schools to have Internet access at subsidised rates, schools to have tax free concessions on all IT equipment,and teachers' skills to be upgraded. Recent education aid projects, such as the Fiji Rural Education Project funded by the European Union and commencing in 2004 and the Fiji Education Support Project funded by AusAID, have ICT components.

We recommend:

3.1 That ICT in education should expand the CS curriculum to include lower grades such as primary school students, particularly in rural and remote areas;
3.2 That IT education be offered in all secondary schools;
3.3 That IT education be introduced in all primary and secondary schools by 2007;
3.4 That this be part of the master plan that is to be prepared for IT education in schools in Fiji.
3.5 That an action plan be developed and costed;
3.6 That this process involve wide consultation with teachers, students and stakeholders.

Recommendation 4 – CS/IT Teachers

We found that almost three out of four teachers have unsecured Grant-in-Aid status. Few have teacher training and there are few professional development opportunities. This situation makes a CS teaching career less attractive and will result in a continuing high turn-over rate.

Logically speaking, if IT is a priority area for Fiji, basic IT education also should be prioritised. The possibility of promotion to Civil Service teacher status and an inducement salary for IT teachers depends on MOE budgeting, but the overall costs and benefits should be considered in the current context of the very critical lack of sustainability of human resources development in both (a) the immediacy of teaching CS/IT in schools, and (b) the long-term consequences of ineffective training of students in an essential field like CS/IT in terms of their future livelihoods and productivity.

The research results show that some students questioned the knowledge and skills of CS teachers. Traditional one-way teaching might need to be reviewed and CS teachers should brush up their knowledge and skills as ICT is continually changing. Since teachers view ICT hardware maintenance as a major problem, this could be one of the possible training topics for teachers.

We recommend:

4.1 That CS/IT teachers have better job security, inducement salary, and scholarship opportunities;
4.2 That CS/IT teachers have opportunities for regular and relevant ICT training and teacher training, including industry experience which enables them to deal with new equipment and maintenance.

Recommendation 5 – Equipment and Infrastructure

The research results show that lack of PCs is a big concern among teachers and students, but 67% of schools stated that they achieved the 2 students per computer ratio in their CS classes. The source of funds was varied: schools themselves, the Government of Fiji, private companies, and International donor agencies. The two schools investigated as best practice schools have quite well equipped laboratories but raised financial concerns. Also, when schools use PCs for other subjects, more PCs are required. We recommend that schools open their labs to the community, which will generate income for the school and also benefit adults in the community

Internet access is a critical issue. After gaining special communication treatment for education, the MOE should also negotiate with Telecom for a special telephone charge. Considering Internet Service Provider charges, the MOE could approach possible institutions, such as USP, that could provide the function of ISP service for all secondary schools.

We recommend:

5.1 That an appropriate amount of good quality equipment be installed in schools to allow them to offer IT education;
5.2 That opening school computer labs for community use be established as a way to raise money to buy equipment;

5.3 That the MOE works with the ICT Regulator to provide Internet access to all secondary schools at a special or free rate;
5.4 That the Government provides meaningful support in infrastructure development, including Internet access for staff and students.

Recommendation 6 – School Principal and Management

Unless school principals and management support IT education, they will not provide equipment nor release teachers for IT-related training and meetings. Conducting awareness workshops for them to emphasize the importance of IT education is an essential step to let them take a leadership role in IT education.

We recommend:
6.1 That principals and management committees take a leadership role to promote IT education in secondary schools.

Recommendation 7 – Networking

In interviews and discussions with teachers and stakeholders, it was made clear to us that regular contact and linking among CS/IT teachers, teachers and TVET, and teachers and stakeholders be encouraged. It was important that all involved be constantly aware of ICT in education and the opportunities that ICT provides.

7.1 That a network linking CS/IT teachers, schools, TVET and stakeholders be established;
7.2 That the South Pacific Computer Society be approached to facilitate and maintain the network in its initial stages;
7.2 That more attachments to smart schools locally and abroad be encouraged by the MOE.

Mid-term recommendations (less than 5 years)

Recommendation 8 – ICT in Education

The current curriculum is very limiting as new teaching approaches and methodologies in IT go beyond computers and are using new communication technologies and multimedia for learning. Furthermore, there is now an emphasis to integrate ICT into general education. This would mean that not only curriculum issues need to be looked at but also pedagogical practices of teachers and students. Fiji's curriculum could examine the possibilities of the more inclusive ICT approach to optimise opportunities.

Although this was beyond the scope of our research, education professionals emphasised that there should be seamless usage of ICT in all subjects. Although this might be wishful thinking to some, taking into account the current situation in Fiji, ICT could be integrated into education in all schools in the near future. ICT could be used as a teaching aid so that the delivery of quality education might be discussed once schools are connected, and it was suggested that this might also alleviate the teacher shortage in schools, especially in the rural areas.

We recommend:

8.1 That the seamless use of ICT in all subjects in schools be initiated;
8.2 That the use of ICT as a teaching aid to alleviate teacher shortages be initiated.

Recommendation 9 – National ICT Standard

There is no national standard in CS/IT curriculum in Fiji. There are also no established indicators for IT use in education. Establishing national standards in CS/IT curriculum, as well as identifying indicators for IT use in education, can be moved on ahead if a body was set up and given this responsibility. In a number of countries, for example Australia, New Zealand, the United States and Germany, such bodies perform useful roles at a time when significant action is being taken towards developing and reviewing CS/IT studies curricula to reflect the needs of society and the changing IT environment.

It is very tempting to make comparisons between the very different best practice schools and also international comparisons, but one should be cautious in doing this as this study dealt with CS/IT curricula and included very broad descriptions and is not a comparative education study. However, it would be interesting to analyse the effects on the education systems of the selection of students in secondary schools, the different kinds of schooling and the performance of students. It can be argued, though, that best practice and case studies can serve as a benchmark for establishing national CS/IT curriculum standards and indicators for IT use and integration in schools. The studies could encourage change in the overall Fiji CS/IT curriculum, refocusing schools in terms of teaching practices and school management, and also assist in developing ICT indicators in schools.

Indicators would include quantitative and qualitative data. Quantitative data usually includes ICT infrastructure and connectivity. This includes hardware and physical networks that connect computers locally and globally. Indicators that measure ICT infrastructure usually include: availability of computer hardware, ratios of computer/student, computer/classroom, computers/teacher, types of computer, availability of connectivity and bandwidth of the computers. Some of these were identified in this study. Useful indicators would also be data that can show how ICT is used as a communication tool which promotes the development of creativity (multimedia and presentation), collaborative learning (class shares), critical thinking and problem solving (programming and networking).[17]

It is important that Fiji establishes standards and if we are seriously concerned about this, then one of the first steps in the process is to support teachers and the practice of teachers. There is a need to listen to the teachers and understand what their needs are in the area of CS/IT. Most critical is the fact that standards of excellence are driven upwards by teachers who are keen, interested and innovative, who challenge themselves as well as their pupils, and who are constantly developing and extending the curriculum, as we witnessed in the two best practice case studies.

This research has actually provided some measure of indicators but this was not the intention of the research. Further investigation and the development of indicators for Fiji schools will be advisable as this will assist in any review of the curriculum which seeks to ensure that all students leaving school are confident, creative and productive users of new technologies, especially ICTs, and who also understand the impact of these technologies on society.

We recommend:
9.1 That Fiji establishes standards in CS/IT education;
9.2 That investigation and the development of indicators for Fiji schools be undertaken;
9.3 That the standards in CS/IT education be monitored by the strengthened TVET, MOE section.

Finally, the whole process and review will require the commitment and support of the government of the day as in the final analysis they control the national curriculum design and the resources allocated to CS/IT.

17. *Developing and using indicators of ICT use in education.* Bangkok: UNESCO, 2003.

Further possible research topics

A number of issues were raised in this research and they need to be examined further. These are described below.

Performance
We did not investigate students' performance in IT subjects. Nor did we identify the factors associated with poor performance and gaps in achievement. This issue should be pursued further. The performance of school leavers in the marketplace could be a good measure of the relevance and appropriateness of the CS/IT curriculum. A more detailed assessment needs be undertaken to establish the level of skills and competencies needed by agencies and the marketplace.

Best solution for computer laboratory installation and networks
Analysis is needed of the best solution for computer laboratory installation and networks at secondary schools in areas with limited resources, since we found that finance is a major problem even within the best practice schools. Computers should be available for IT education. Using networked PC labs without installing Operating System into all PCs or recycling PCs could be an alternative. Using Open Source is an option too. Freeware application, establishment and trial, and piloting of small projects might be one component of research.

Changing role of the teacher
It has been argued that the introduction and greater use of new technologies will impact on the role of the teacher in a number of ways. There is a need to undertake in-depth investigation to identify whether there is any change taking place in the role of teachers in the current and future IT environment and in relation to culture and pedagogy. New technologies have brought in new ways of teaching and new styles. Studies should be undertaken to determine how traditional knowledge as well as traditional methods of teaching such as "talanoa" could complement the modern methods.

Education planning and policy
Studies have shown that a continuous 5-year contract for teachers has a positive effect on student achievement, teacher performance and development, compared to when teachers have shorter contracts. There is a need to carry out an in-depth investigation on the impact and effect on student performance and quality of CS/IT teaching of having different categories of teachers – Grant-in-Aid, temporary Civil Service teachers, Civil Service teachers. This can be viewed from the perspective of the teachers, from the students, from MOE management and from a financial point of view. A cost benefit analysis may provide some solution to ensuring security and retention of good teachers within limited budgetary allocations.

CONCLUSION

The Government of Fiji acknowledges the potential of ICT to provide great opportunities in education and development in the country. Its Strategic Development Plan (2002) provides the Government's vision and plan, aligning Fiji's IT training to developments in the employment market and producing trained people with basic generic CS/IT skills as well as trained technicians, engineers and programmers. With this objective, IT education should be given priority, including appropriate funding to improve student achievement. This can be done by strengthening the capacity of many schools that offer or plan to introduce IT education and also strengthening the TVET section in the MOE that deals with IT education. Such recognition would encourage more school management boards and principals to place priority on IT education.

This research attempted to review the current CS/IT curriculum and evaluate its effectiveness and appropriateness for the students. While the research results could not confirm the agencies' strong demand for school leavers to have more IT knowledge, it was clear from the students, agencies and teachers that the present CS/IT curriculum must be revised. Tertiary institutions, CS/IT teachers and other stakeholders in Fiji were demanding a change in the current CS/IT education at secondary school.

In addition, while we did not pursue the performance of the students in detail, we found that the young generation is keen to learn ICT for their future career, and is frustrated with the old curriculum and traditional classroom approach. They argued that the curriculum should 1) be more updated, 2) be more practice oriented, 3) be more flexible for learners' future plans, and 4) prioritize logical thinking. However, what we found most important was the need for a holistic approach to having quality IT education at secondary schools as a desired output.

Hence, the need for a curriculum update, review and change. This is seen as urgent, now and even more so in the future, with the rapid developments and changes taking place in technology. There is a need to put in place mechanisms and processes to periodically review and update the curriculum.

In this research we identified many difficulties and challenges in the current CS/IT education: lack of appropriate PC laboratories and Internet access, limited financial and learning resources, uncertain sustainability situations, job insecurity of CS/IT teachers, limited opportunities for further education for CS/IT teachers, and little networking among stakeholders. All are interrelated and, together, contribute to the status quo.

To ensure that some consolidated effort in curriculum review is undertaken, and the whole issue of ICT use in education is addressed, the research identified the need to develop a strategic master plan for CS/IT education and training in schools as one of the short term activities. This should encompass the needs of industry, the ability of the institutions to meet the demands made by students and the community, teacher training needs, resources needs and research programs and the role of CS/IT in the future development of the country. It is hoped that the plan will include efforts to take CS/IT education to rural schools. It is also hoped that the plan will address the wider issue of ICT integration in schools. This will ensure quality IT education and education overall. This undertaking will require the collaboration of the various stakeholders, including students, parents, teachers and agencies.

This research has achieved a number of positive outcomes, the most important of which are that it has raised the profile of CS/IT in the schools, it has highlighted the needs of students and teachers in IT, it has established a much-needed network of teachers of CS/IT and it has provided many new ideas, actions and plans for the future. We expect this relationship will continue and take the CS/IT teachers' training agenda to a higher level.

The research has highlighted important needs to improve IT education. We expect our research will be a small first step to enhance basic ICT education in Fiji to improve people's lives.

REFERENCES

Byron, I. & R.Gagliardi (1998, January 28). *Communication and the Information Society: The Role of Information and Communication Technologies in Education*. UNESCO: International Bureau of Education (IBE). http://www.idrc.ca/ACACIA/old/studies/ir-unesco-1.html

Fiji Information Technology Development Policy. (2003) Suva: Government of Fiji.

Fiji. Ministry of Education. *Annual Report*, 2000-2002.

Fiji. Ministry of Education. MOE Database. Accessible online at http://www.fijichris.gov.fj/Dr/DB-MOE11.htm

Fiji. Parliamentary Paper. (2002) Strategic Development Plan 2003 – 2005: Rebuilding Confidence for Stability and Growth for a Peaceful, Prosperous Fiji. Suva: Government of Fiji. Parliamentary Paper No 72 of 2002.

Goldhaber, D., & D.Brewer, (2000, Summer). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis, 22(2),* 129-145. (EJ 615 883).

Hanushek, E.A., J.F.Kain and S.G.Rivkin (1999) *Do Salaries Buy Better Teachers?* Working paper No. 7082. Cambridge: National Bureau of Economic Research.

Cwikla, Julie (2002) *Differential Mathematics Performance on the TIMSS-R Across Delaware Students of Colour*. Delaware, University of Southern Mississippi.

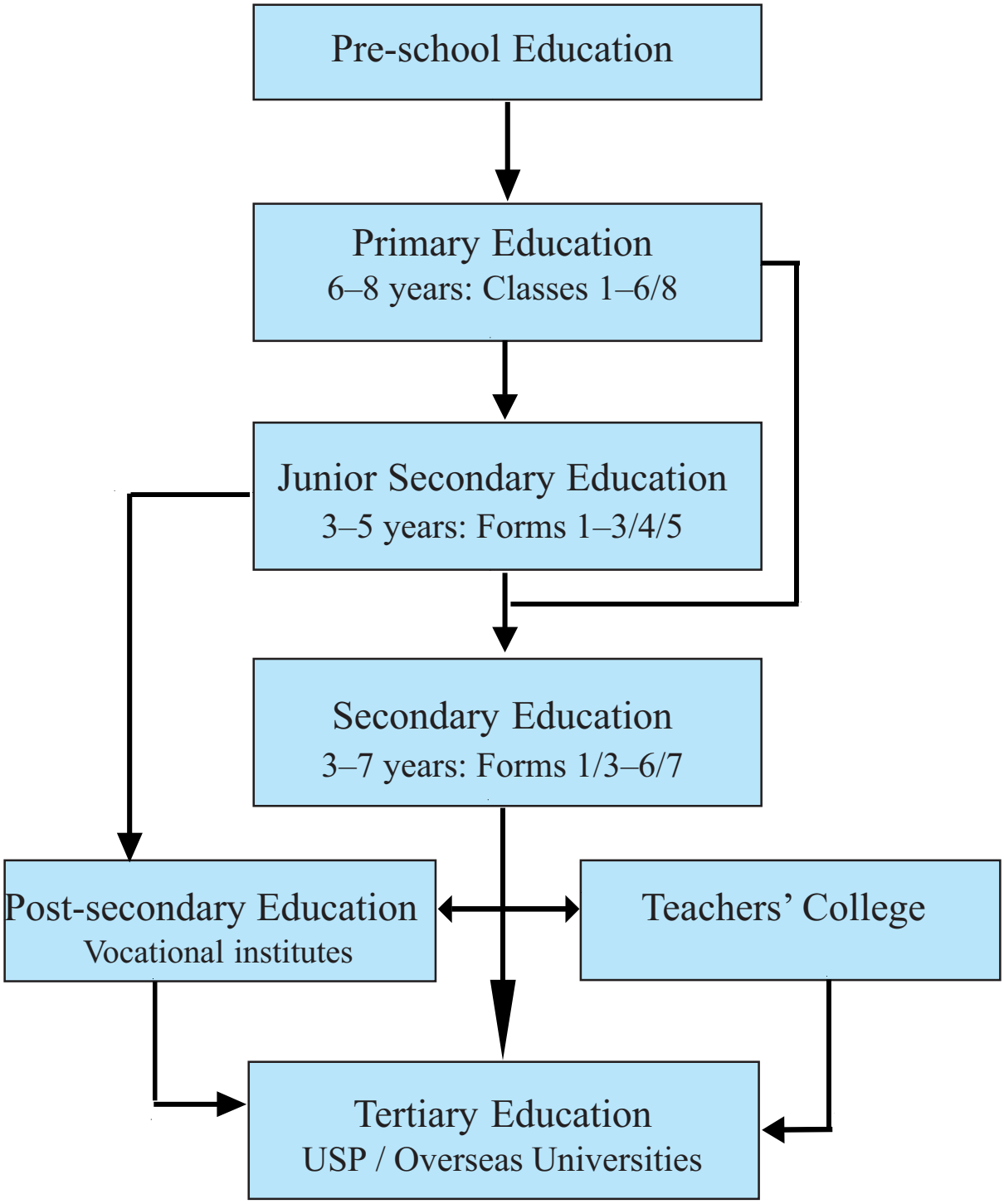
International Telecommunication Union. *Trends in Telecommunication Reform 2002.* Geneva: ITU, 2002. Accessible online at http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet02.pdf

Kimbell, R. (1997) Assessing Technology: International Trends in Curriculum and Assessment. Buckingham: Open University Press.

Kober, N. (2001) *It takes more than testing: Closing the Achievement gap.* A Report of the Centre on Education Policy. www.ctredpol.org

Learning Together: Directions for Education in the Fiji Islands.(2000) Report of the Fiji Islands Education Commission/Panel. Suva: Government of Fiji (Ministry of Education).

ANNEX 1: EDUCATIONAL STRUCTURE IN FIJI



Source: USP Knowledgebase, 2002–2003,<http://www.rkb.usp.ac.fj/rkb/default.asp>

ANNEX 2: RESULTS OF THE FIJI SEVENTH FORM EXAMINATION, 2001

GRADES OF PASS PER SUBJECT BY RACE

SUBJECT	TOTAL NO. OF CANDIDATES SAT				GRADE A				GRADE B				Total No. of Passes
	FIJ	IND	OTH	TOT	FIJ	IND	OTH	TOT	FIJ	IND	OTH	TOT	
English	1232 31%	2351 62%	175	3758	30	106	13	149	176	514	49	739	2457
Mathematics	1151 32%	2307 64%	151	3609	3	138	7	148	121	650	25	796	2345
Biology	387	873	52	1312	4	59	5	68	30	238	12	280	896
Chemistry	381	1044	71	1496	1	68	4	73	34	312	19	365	1063
Physics	252	763	70	1085		74	5	79	27	250	18	295	858
Geography	615	708	62	1385	11	26	2	39	30	140	14	184	864
History	329	36	35	400	3	1	1	5	29	5	5	39	182
Accounting	329	1163	45	1537		57	1	58	20	302	5	327	1051
Economics	543	1111	71	1725	3	66	3	72	45	287	17	349	1138
Agri. Science	143	182	12	337					4	28	1	33	146
Apparel & Design		6		6									3
Introduction to Technology	38	96	8	142		7	1	8	4	33	4	41	110
Food Technology	63	142	9	214					3	24	1	28	110
TecH Drawing & Design	84	141	22	247		13	1	14	6	41	2	49	174
Computer Studies	120 20%	457 75%	34 6%	611		38 6%	1	39 6%	11	141	9	161 26%	451 74%
Fijian	193	1	194	6			6	48			48	54	
Hindi		117		117		1		1		17		17	69
Urdu		18	1	19		1		1		1		1	13

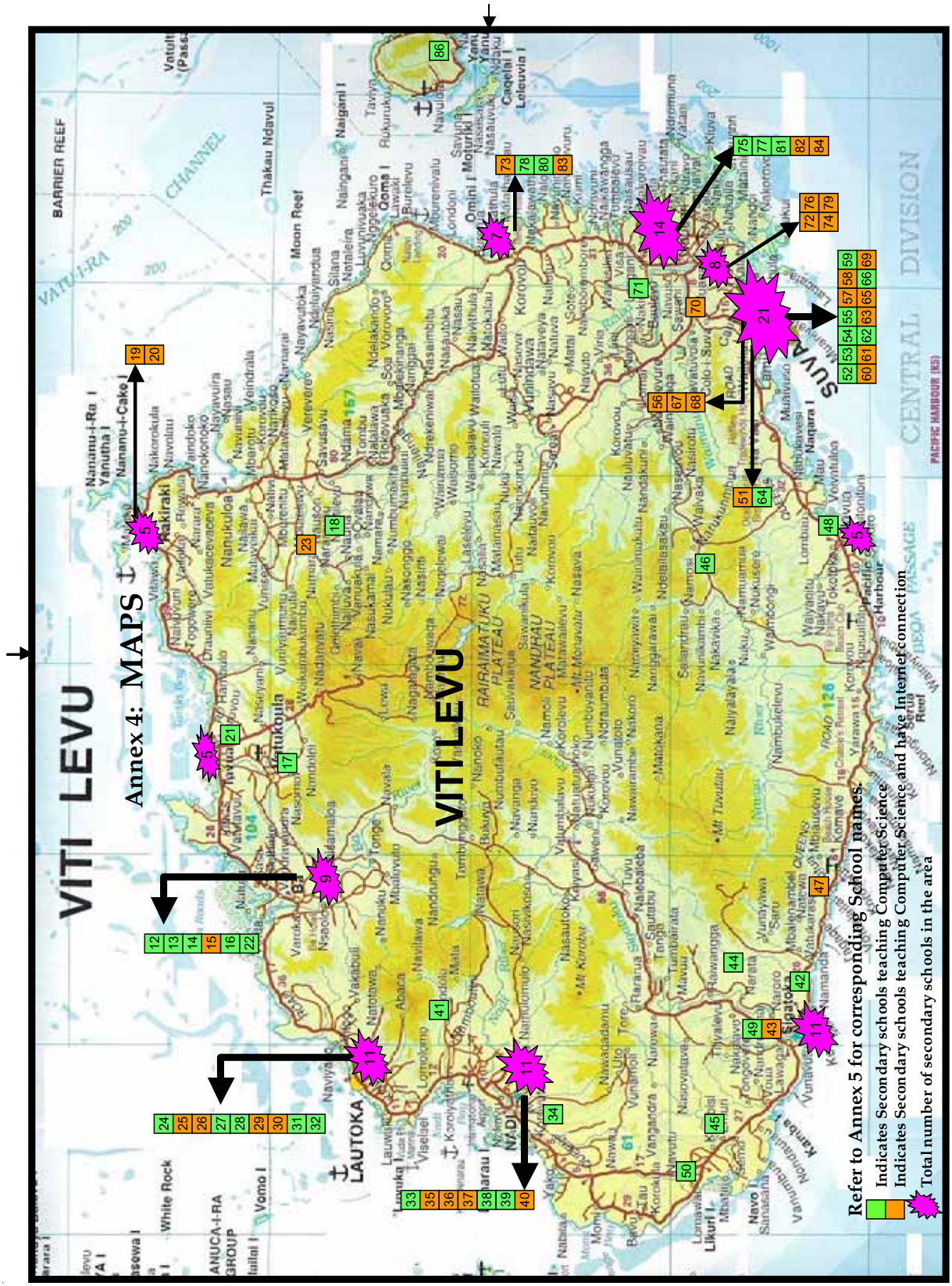
ANNEX 3: Staff Resignations at ITC Section in Fiji Islands in 2000•E001

	Post	Recruited	Date Left	Reason for Leaving
		2000		
1.	Senior Programmer		28/04/00	Migrated to Australia
2.	Assistant Programmer		28/04/00	Migrated to Australia
3.	Assistant Programmer		28/04/00	Migrated to Canada
4.	System Analyst		10/5/2000	Migrated to Australia
5.	System Analyst		09/06/00	Migrated to Australia
6.	Supervisor		11/10/00	Job at PAFCO Levuka
		2001		
1.	Asst. Manager Operations	04/01/93	15/07/01	Left for private company
2.	Systems Analyst	13/05/98	03/03/01	Migrated to Australia
3.	Systems Analyst	28/03/94	05/10/01	Left for private company
4.	Systems Analyst	02/11/98	11/06/98	Migrated to Australia
5.	Systems Analyst	20/10/99	14/02/01	Migrated to Australia
6.	Systems Analyst	05/01/98	28/12/01	Left for private company
7.	Assistant Programmer	01/01/93	31/08/01	Left for Telecom
8.	Assistant Programmer	04/04/98	15/06/01	Study in USA
9.	Assistant Programmer	23/11/98	19/06/01	Migrated to Australia
10	Computer Operator	08/08/78	01/06/01	Migrated to NZ
11	Storeman	22/09/97	09/0701	Migrated to UK
12	Computer Operator	12/02/92	06/05/01	Transferred to Met.Office

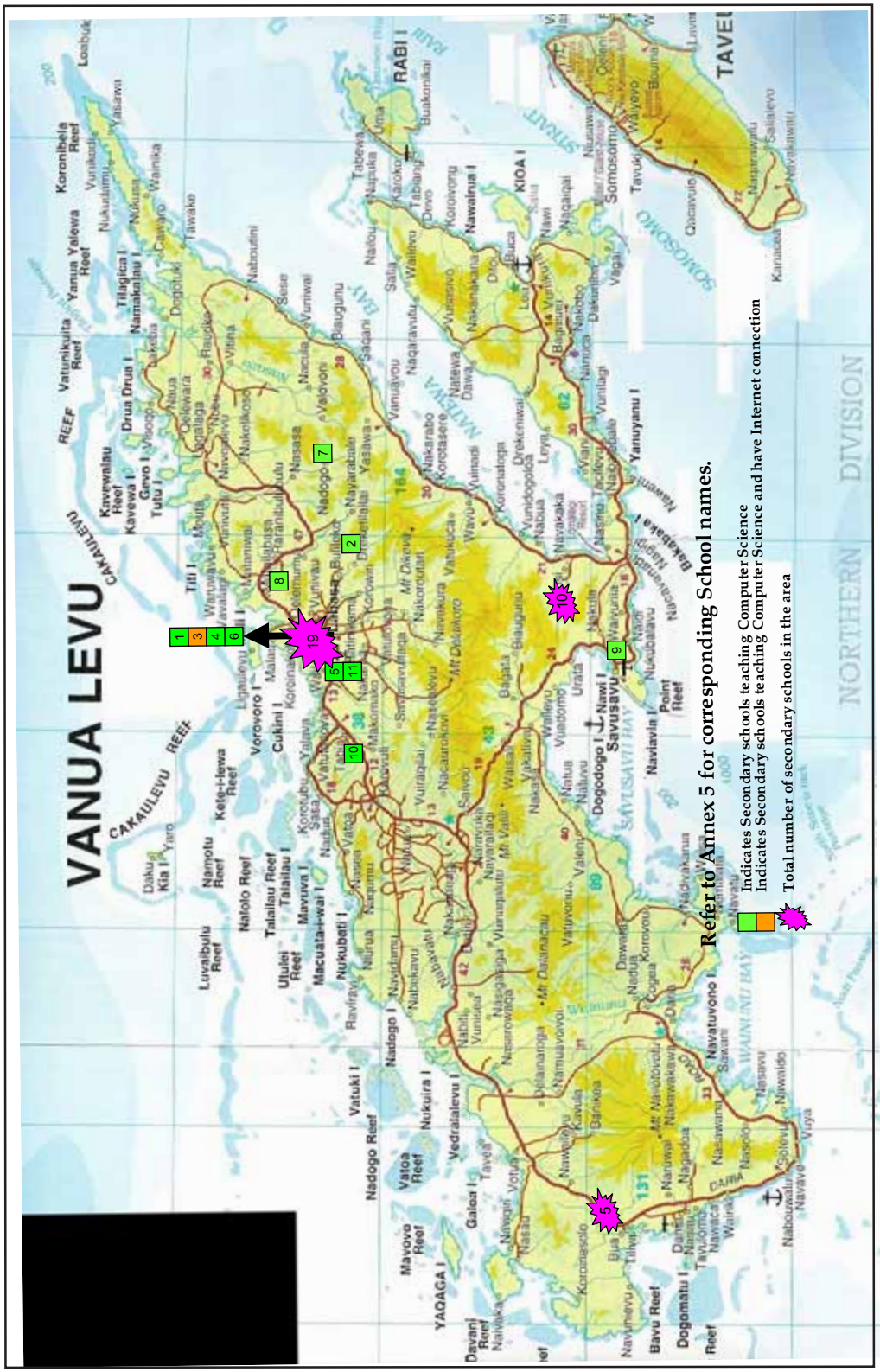
Source: Ministry of Information Technology and Computing Services, Annual Report for 2000 and 2001.

ANNEX 4 MAPS

Viti Levu



Vanua Levu


VANUA LEVU
Refer to Annex 5 for corresponding School names.
Indicates Secondary schools teaching Computer Science
Indicates Secondary schools teaching Computer Science and have Internet connection
Total number of secondary schools in the area

Kadavu

Lomaiviti 5

Lau 5

Please refer to Annex 5 for corresponding School names.

Indicates Secondary schools teaching Computer Science

Indicates Secondary schools teaching Computer Science and have Internet connection

Total number of secondary schools in the area

ANNEX 5: SCHOOLS OFFERING CS/IT EDUCATION •E2002

CS-teaching secondary schools with Internet access

LABASA DISTRICT SCHOOLS (11 SCHOOLS)

All Saints Secondary School
Bulileka Sec. School
Holy Family Secondary
Labasa College
Labasa Muslim College
Labasa Sangam College
Nadogo Secondary School
Naleba College
Savusavu Secondary School
Tabia Sanatan College
Waiqele Secondary

BA/TAVUA/RAKIRAKI (12 SCHOOLS)

AD Patel Memorial School
Ba Sangam College
DAV College
Kamil Muslim College
Khalsa College
Nilsen High School
Nukuloa College
Penang Sangam School
Rakiraki Public
Tavua College
Xavier College
Nakauvadra High

LAUTOKA SCHOOLS (9 SCHOOLS)

Ba Provincial Secondary
Drasa Secondary School
Jasper Williams High School
Lautoka Central College
Lautoka Muslim College
Natabua High School
St. Thomas High School
Tilak High School
Vishnu Deo Memorial

NADI SCHOOLS (9 SCHOOLS)

Mulomulo Secondary School
Korovuto Seconday School
Nadi College
Nadi Muslim College
Ratu Navula Secondary*
Sabeto Secondary School
Sangam (SKM) College
Swamy Vivekananda High
Votualevu Sec.School

SIGATOKA/NAVUA (9 SCHOOLS)

Andhra High School
Cuvu Secondary
Kavanagasau Secondary
Nadroga Arya College
Namosi Secondary School
Nasikawa Vision College
Rampur College
Sigatoka Methodist
Lomawai Secondary

SUVA SCHOOL (19 SCHOOLS)

Ballantine Memorial School
Cathedral Secondary School
Dudley High School
DAV Boys Clollege
DAV Girls College
LDS Technical College
Gospel High School
Indian College
Laucala Bay Secondary
Mahatma Ghandhi Memorial
Marist Brothers High
Rt. Sukuna Memorial School
St. Joseph's Secondary School
Suva Adventist High
Suva Grammer School
Suva Sangam School
Suva Muslim College
Nabua Secondary
Yat Sen Secondary School

NASINU/TAILEVU SCHOOLS (15 SCHOOLS)

Adi Cakobau School
Baulevu High School
Bhawani Dayal High
Fulton College
Lelean Memorial School
Nausori High
Nasinu Muslim College
Pt. Shreedhar Maharaj College
Queen Victoria School
Rishikul Sanatan College
Ratu Kadavulevu School
Saraswati College
Sila Central High
Tailevu North High
Vunimono High School

KADAVU SCHOOLS (1 SCHOOL)

Vunisea Secondary School

OVALAU SCHOOLS (1 SCHOOL)

St. John's College

ANNEX 6: Research Sample of Agencies, Students and Teachers

School – Students	
Adventist High Sch	1
All Saints Sec	11
Bhawani Dayal	13
DAV Girls College	12
Gospel High School	11
Indian College	13
Labasa College	1
Labasa Sangam College	44
LDS Church College	8
Lelean Memorial Sch	1
MGM High	2
Nasinu Muslim College	13
Natabua High	1
Nilsen High sch	10
Penang	13
Rampur College	1
Ratu Navula Sec	1
Ratu Navula Sec Sch	3
Ratu Sukuna	1
Sigatoka Methodist High	22
SJSS	5
Suva Grammar Sch	1
Suva Muslim	12
Swami Vivekananda Coll	13
Xavier College	1
Yat Sen Sec	3
Total	**217**

School – CS teachers	
Adi Cakobau Sch	1
All Saints Sec	1
Ba Provincial Secondary	1
Ba Sangam	1
Cathedral Sec	1
Cuvu College	1
DAV College	1
DAV Girls Coll	1
Drasa Sec.	1
Fulton College	1
Gospel High School	1
Indian College	1
Labasa College	1
Labasa Muslim College	1
Labasa Sangam College	2
Lelean Memorial Sch	1
MGM High School	1
Nadi Muslim College	1
Nadroga Arya College	1
Nakauvadra High Scho	1
Namosi Secondary	1
Nasikawa Vision College	1
Nasinu Muslim College	1
Natabua High Sch	1
Nausori High Sch	1
Nilsen High Sch	1
Penang Sangam High Sch	1
Rakiraki Public High Sch	1
Rishikul College	2
Rt. Navula Sec Sch	1
Sabeto Secondary Sch	1
Sangam College	1
Shreedhar Maharaj	1
Sigatoka Andhra Sangam College	1
Sigatoka Methodist	1
Suva Muslim College	1
Suva Sangam High Sch	1
Swami Vivekananda College	1
Tabia Sanatan College	1
Vishnu Deo College	1
Vunimono High Sch	1
Waiqele Sec.	1
Total	**44**

Corporate Agency	
ANZ Bank	1
Bureau of Statistics	1
Communications Fiji Ltd	1
Fiji Broadcasting Corporation	1
Fiji COSS	1
Fiji Police Force	1
Fiji TV	1
Food 4 Less Supermarket	1
Forum Secretariat	1
HFC Finance	1
Homecentres Fiji Ltd	1
KFC	1
LICI	1
Marsh Ltd	1
McDonalds Laucala	1
Merchant Finance	1
Ministry of Finance	1
NLTB	1
Post Fiji Ltd	1
R B Patel	1
Rentokil Initial Ltd	1
Safeway Electronics Ltd	1
SPC	1
Telecom Fiji	1
Vinod Patel & Co. Ltd	1
Vodafone Fiji Ltd	1
Wespac Bank	1
Total	**27**

ANNEX 7: Nadi Muslim College (NMC) Smart School Plan

NMC Smart School Implementation Plan

The project is being implemented in 3 stages:

- Stage 1 (completed) – base infrastructure including initial Data Centre, LAN Server, Web Server, CAT 5 Cabling , Laser Printers and initial batch of 60 PC'S & Furniture
- Stage 2 (completed) – overhead projection for Form 7, additional PCs (40) and School Management Software
- Stage 3 (2003 – 2005) additional PCs (100), new IT Centre, tertiary curriculum and possibly FML LAN WAN and intranet

Objectives of the NMC Smart School

- to produce the most competent and capable IT students;
- to be the leading provider of IT skills in the market;
- to provide leadership in creating a blueprint for FML'S technology-based education strategy;
- to provide leadership to create a forum for the Ministry of Education, employers, communities, schools and educational institutes – "The Fiji IT Consultative Forum".

Features of a Smart School

Technology enabled with the industrial strength infrastructure:

- to administer the school operation,
- to enable Value Added Teaching,
- to deliver information technology curriculum,
- to deliver approved and optional curriculum,
- to provide students and teachers with open access and school wide connectivity,
- to provide schools with global connectivity to the World Wide Web,
- to enable information librarianship.

Current Capabilities and Achievements to Date

- The current system provides school-wide connectivity.
- Is capable of at least 200 ports.
- Teachers are compiling student notes and a central repository.
- Student notes are published on Laser printers.
- Capability to support day to day maintenance of the LAN and Servers.

Issues and Concerns

- Internet connectivity costs and responsiveness of Telecom Fiji
- Potential lack of quality teachers in IT
- Teachers' lack of global exposure to the IT environment
- Community support to sustain the ongoing development of the capability and environment

ANNEX 8: Symposium Recommendations to the MOE

The need for a holistic approach to CS education (28 March 2003)

CS in General

- Strategic needs and planning (staging)
- To offer CS to a wider target group
- To offer courses that reflect the new and changing trends in CS developments and training
- Raise awareness of decision-makers in government on the importance of CS education and seek their support
- Work towards CS becoming an examinable (core) subject
- Need to review and introduce new external assessment methods
- Regular review or monitor of CS curricula
- Regular updating and training of CS teachers
- Capacity building in CS/TVET section in the MOE

Strategy

- To introduce CS as early as possible to encourage algorithmic thinking
- CS to be an examinable subject in all schools as soon as practicable
- To plan a new curriculum by the end of 2003
- To create a CS Department in all schools
- To put in place a plan to ensure security of CS teachers
- To ensure that the new CS curriculum and related plans reflect the priorities of the national ICT Policy• That school and community facilities be shared for use for CS education

CS Curricula

- More Flexible
- More practical
- Review of necessary contents
- Up to date such as hardware and program language
- More study of algorism concept

(Utilise the limited resource at maximum)

Some Recommendations for Content for Forms 5 and 6

- Integrate text with the curriculum
- Identify tools for teaching – basic skills, such as keyboard skills
- Revise topics in the curriculum regularly
- Need for fieldtrips
- Simple program language
- Database curriculum
- Remove the current BASIC program
- Algorithmic thinking approach
- Modular approach
- Computing across the curriculum to be promoted
- Algorithmic thinking mathematics

Form 7

- Develop USP foundation course
- 2 separate courses, one for each semester
- "IT fluency" and "IT literacy"

Assessment

- Must test thinking not memorisation
- Increase topics and in depths
- Digitisation of external text to avoid easiness, irrelevance, and mistakes
- Needs more practical assessment till 50:50

Teacher Education

- New courses for teacher education by tertiary or vocational institutions
- Collaborative learning through teacher networking
- Principals' awareness raising
- Self-learning

CS Teacher Education

- Education by face-to-face and DFL mode in the future
- Infrastructure should be set up
- Education delivery by media
- Education for media

Self Education

- Various delivery such as books, materials, internet, e-mail, phone. However, up to accessibility of Internet
- MOE's help such as workshop and incentive raising
- Self-funding and self-development
- Seek grants

CS Teacher Job Security

- In-service teacher training
- Post creation-establishment of civil servant posts
- Creation of CS departments in schools
- Unconfirmed posts (TCS) to be managed better
- All CS teachers to come under TVET
- Preference of post holders

Teacher Networking

- Support from MOE – attachments to smart schools, local and overseas institutions, etc.
- To create a link between CS teachers, schools, MOE and stakeholders
- Building small working groups
- E-awareness
- Better organisation/management within MOE
- South Pacific Computer Society (based in USP) to facilitate the network in its initial stages

Infrastructure

- More funds to schools for PCs
- Strategies for more use and access – private sector, rotary for support
- More administrative system
- Government, other stakeholders and interested groups to support free Internet use in schools
- Provide electricity or alternative sources of energy to rural schools

Education for ICT "subject" and "tools"

- Updated Computer Science education for students
- Education for ICT as "tools"
- Target for necessary students (adults if school opens for community) at an earlier age
- Towards seamless utilisation of ICT in all subjects
- Creative ways to encourage CS training, especially in schools in rural areas

ANNEX 9: CS111 & CS122 (USP) COURSE OUTLINES

CS111 Introduction to Computing Science

Prerequisite: Either a pass in CS121, or Form 7 Mathematics pass with at least 60%, or at least a C+ average in MAF12.

This course provides an introduction to computing programming language hierarchy (machine, assembly, high-level) and basic computer organization (i/o, main storage and CPU); and, problem solving and algorithms using a modern high level language, programme design, structured programming concepts, debugging, testing and documentation and application.

CS122 Information Systems II

Prerequisite: CS111 or CS121

This course follows from CS121 and provides a solid foundation in a high-level language widely used in business and administrative data processing. The language is taught using structured programming principles. Topics will be chosen from programming discipline, programme documentation, structure programming and application of the language to sequential processing, report generation, databases, searching and sequential file processing.

ANNEX 10: FIJI/JAPAN COMPARISON

Comparison of Fiji Islands and Japan
Secondary School CS/IT Curriculum

UNIT	FIJI (All compulsory)	JAPAN	
Unit 1.	Structure and Functions of a Computer (T) Using the Computer (P)	ICT Industry and Society	
Unit 2.	History of Computers (T) Word Processing (P)	Project: Select **one** of the following future plans: 2-1) Research or Experiment 2-2) Production 2-3) Practice in the field 2-4) Certification organization	
Unit 3.	Computers and Information Processing (T) Information Processing (P)	Practice: Select **one** of the following future plans: 3-1) Basic 3-2) System design and management 3-3) Multimedia	
Unit 4.	Programming (T) Programming (P)	Information and Expression with Multimedia	compulsory
Unit 5.	Computers in Society (T) Spreadsheet (P)	Algorithm	
Unit 6.	Computers and Careers (T) Intermediate Concepts and Optional Applications (P)	Development of Information System	
Unit 7.		Network System	
Unit 8.		Modeling and Simulation	
Unit 9.		Computer Design	
Unit 10.		Computer Graphics	
Unit 11.		Multimedia with movie and Music	

(T) – Theory
(P) – Practice

ANNEX 11: QUESTIONNAIRES

AGENCY QUESTIONNAIRE

EVALUATION OF COMPUTER SCIENCE CURRICULUM IN FIJI SECONDARY SCHOOLS

SECTION 1: AGENCY DETAILS

Please provide the following information:

Name: _____ Position: _____

Name of Agency:_____

Agency address (postal):_____

Agency phone:_____mobile: _____ fax:_____

Agency and personal email:_____

1. Is your agency engaged in the area of Information, Communications and Technology (ICT)?
   1. ☐ Yes 2. ☐ No
2. If yes, please explain how.

_____

_____

3. Has your agency ever been involved in strengthening the delivery of Computer Science education in Fiji secondary schools?
   1. ☐ Yes ☐ No, but we are planning some activities
   2. ☐ No
4. If the response was 1 above, please clearly specify how your agency was involved or is planning to be involved in the future?

_____

_____

SECTION 2: SKILLS FOR EMPLOYMENT

5. Does your agency employ recent school-leavers?
   1. ☐ Yes 2. ☐ No
6. If yes, please rate what level of skills your agency requires from these school-leavers in the use of these applications.

	Application	Highly skilled to work without any training by us (a)	Sufficient skill, but some training will be (b)	Very little skill, intensive training will be provided (c)	No prior skill is needed as we train all our new staff in computer use thoroughly (d)
1	Computers in general				
2	Word processing packages				
3	Spreadsheets				
4	Databases				
5	Graphical applications				
6.	Presentation software (e.g. Power Point)				
7	Desktop publishing				
8	Any Internet activity				
9	Web page development				
10.	Email				
11.	Knowledge of IT jargon				
12.	Keyboard skills				

7. Do you find the recent school-leavers who studied CS in secondary schools to be sufficiently skilled to work in your agency?

   1. ☐ Yes 2. ☐ No

8. If no, what are their limitations in the use of computers?

9. Do you think that the present CS curriculum in secondary schools provides good basic training in computer application usage to students? (Please view the enclosed outline of the CS curriculum by the Ministry of Education).

   1. ☐ Yes 2. ☐ No

10. If no, please give your reasons.

11. What other important and basic areas of study should be included?

12. If the Ministry of Education invited your agency to become part of the CS curriculum advisory committee, meeting at least three times annually, would your agency participate?

    1. ☐ Yes 2. ☐ No

13. If yes, please describe how your agency could contribute towards the work of this committee?

14. If your agency was requested to provide a few weeks' intensive training/industry placement for CS teachers, would your agency agree to this?

    1. ☐ Yes 2. ☐ No

15. What other forms of assistance can your agency provide towards CS/IT training in schools? Please note these here.

16. Would you be able to provide career talks for schools if requested?

    1. ☐ Yes 2. ☐ No

17. How would you rate the following in terms of limitations in the secondary schools?

	Not a barrier(1)	Minor barrier(2)	Major barrier(3)
a. Lack of electricity, frequent power cuts			
b. Not enough or limited access to computers			
c. Not enough computer software.			
d. Purchased software has not been installed.			
e. The school does not have facility to house computers.			
f. Maintenance of computers is very expensive.			
g. Lack of time in school schedule for projects involving technology.			
h. Use of technology not integrated into curriculum documents.			
i. Lack of adequate technical support for technology projects.			
j. Lack of trained teachers to teach CS			
k. Technology integrated is not a school priority.			
l. Students do not have access to the necessary technology at home.			
m. Internet connection is too expensive.			

STUDENT QUESTIONNAIRE

EVALUATION OF COMPUTER SCIENCE CURRICULUM IN FIJI SECONDARY SCHOOLS

SECTION 1: PERSONAL DETAILS

Please provide the following information:

Name:_____ Name of school:_____

School address (postal):_____

Your phone:_____mobile: _____ fax:_____

School and personal email:_____

1. In which grade are you presently studying?

   1. ☐ Form 1 2. ☐ Form 2 3. ☐ Form 3
   4. ☐ Form 4 5. ☐ Form 5 6. ☐ Form 6
   7. ☐ Form 7 8. ☐ Other, please specify

SECTION 2: COMPUTER SCIENCE EDUCATION

2. What subject areas do you take in your present grade? (please check all that apply)

   1. ☐ Mathematics 2. ☐ Social Studies
   3. ☐ Second languages 4. ☐ Physical Education
   5. ☐ Vocational education 6. ☐ Special education
   7. ☐ Physics 8. ☐ Chemistry
   9. ☐ Biology 10. ☐ Accounting
   11. ☐ Economics 12. ☐ English
   13. ☐ Religious studies 14. ☐ Computing Science
   15. ☐ Other, please specify

3. Did you take Computer Science (CS) as an examinable subject last year?

   1. ☐ Yes 2. ☐ No

4. If yes, please clearly state your reasons for selecting CS.

   _____

   _____

5. Did you achieve what you thought you would from taking CS in school?

   1. ☐ Yes 2. ☐ No

6. If no, please give reasons.

   _____

   _____

7. Do you get access to a computer during CS classes?

   1. ☐ Yes, we all have a computer each.
   2. ☐ Yes, two persons share a computer.
   3. ☐ Yes, more than two persons share a computer.
   4. ☐ No, only the teacher has a computer.
   5. ☐ No, no one has a computer.

8. Approximately how often are you taught these applications during CS classes?

Application		Daily (a)	Weekly (b)	Monthly (c)	Yearly (d)	Never (e)	Not available (f)
1	Computers in general						
2	Word processing packages e.g. Word						
3	Spreadsheets e.g. Excel						
4	Databases e.g. Access						
5	Graphical applications						
6	Presentation software (e.g., Power Point)						
7	Desktop publishing						
8	Any Internet activity						
9.	Search engines for the Internet (e.g., Yahoo, Google)						
10	Simulation Programs						
11	Drill/Practice Programs, Tutorials						

9. Are you proficient in the use of the above-mentioned applications that you use daily/ weekly?
   1. ☐ Yes 2. ☐ No
10. If no, please give reasons why you are still not comfortable with these applications.

SECTION 3: ENVIRONMENT

11. Does your school have access to the Internet?
    1. ☐ Yes 2. ☐ No
12. Are students allowed access to the Internet?
    1. ☐ Yes 2. ☐ No
13. How many hours on average per week do you spend on the computer at school?
    _____ hours.
14. How many hours on average per week do you spend using the Internet at school?
    _____ hours.
15. What are the main purposes of computer usage by you?

16. Do you have access to the Internet at your home?
    1. ☐ Yes 2. ☐ No
17. If yes, do you use the home Internet to prepare your school assignments?
    1. ☐ Yes 2. ☐ No
18. If yes, do you think this has improved your standard of school work compared to before, when you were not using the Internet?
    1. ☐ Yes, huge improvement in my school work.
    2. ☐ Yes, a little improvement.
    3. ☐ No, there has been no difference at all.
19. Do you think that you have an advantage over students that don't have access to the Internet at all?
    1. ☐ Yes 2. ☐ No
    3. ☐ Maybe 4. ☐ Not sure
20. If yes, please clearly state, what you believe are your advantages?

SECTION 4: CHALLENGES

21. Indicate whether any of the following are barriers to learning CS in your school.

	Not a barrier (1)	Minor barrier (2)	Major barrier (3)
a) Lack of electricity/ frequent power cuts			
b) Not enough computers			
c) Software applications are very old			
d) The school does not have proper facility to house computers			
e) The computers are obsolete			
f) Computers are frequently out of order			
g) Computer maintenance takes too long			
h) Lack of trained teachers to teach CS			
i) Large classes (more than 40 students at a time)			
j) Not enough guidance by teachers			
k) Students' attitude			
l) Have no access to computers during CS classes for practical use			
m) Most CS classes are too theoretical			
n) Little cooperation from parents			
o) Little priority given to teaching CS, e.g. other subjects are taken during this period usually			

SECTION 5: CURRICULUM ASSESSMENT

22. How does your teacher assess the students for the CS subject? (check all that apply)

1. ☐ Presentations by students
2. ☐ Individual exercises
3. ☐ Group project
4. ☐ Test
5. ☐ Written/Practical Assignments
6. ☐ Others, please specify

23. Do you think what you are taught during the CS classes is

1. ☐ very effective and useful outside schools as well?
2. ☐ somewhat useful, but needs to reflect recent developments in the IT field?
3. ☐ ineffective and needs to be drastically changed?

24. Please give your reasons for your response above.

_____

_____

SECTION 6: SKILLS FOR EMPLOYMENT

25. Do you think that what you have learnt in the CS classes will be useful to you as an employment skill?

1. ☐ Yes 2. ☐ No 3. ☐ Not sure

26. Have you ever worked outside school hours, such as holiday work etc.?

1. ☐ Yes 2. ☐ No

27. If yes, did this work involve computers?

1. ☐ Yes 2. ☐ No

28. If yes, were you able to utilize what you had learnt in the CS classes?

1. ☐ Yes 2. ☐ No

29. For either response, please clearly state your reasons.

_____

_____

30. Any other comments relating to this issue.

_____

_____

TEACHER QUESTIONNAIRE

EVALUATION OF COMPUTER SCIENCE CURRICULUM IN FIJI SECONDARY SCHOOLS

SECTION 1: PERSONAL DETAILS

Please provide the following information:

Name:_____ Name of the school:_____

School address (postal):_____

Your phone:_____mobile: _____ fax:_____

School and personal email:_____

1. Gender

   1. ☐ Male 2. ☐ Female

2. Ethnicity

   1. ☐ Indian 2. ☐ Fijian 3. ☐ Chinese
   4. ☐ European 5. ☐ Other Pacific Islander 6. ☐ Others

3. Please state your age? _____ years.

SECTION 2: CAREER

4. What are your qualifications, and please specify the Major in each? (Check all that apply)

   1. ☐ PhD 2. ☐ Masters,
   3. ☐ Degree, 4. ☐ Diploma
   5. ☐ Certificate 6. ☐ Others

5. Please state the country and institute where you studied for any qualifications relating to Computer Science/ Information Technology

   Country Institute

_____

6. What is your present annual salary? _____

SECTION 3: INTERESTS & TRAINING

7. What Computing Science (CS) areas are you interested in? (Check all that apply)

   1. ☐ Physical 2. ☐ Network
   3. ☐ Application 4. ☐ Others, please specify

8. In the past year did you participate in any of the following types professional development activities related to technology?

	Yes	No	No. of hours	Who was this activity funded by?
a. Workshop/seminar focused on a specific topic.				
b. Courses offered by the university.				
c. Teacher clubs connecting teachers regionally, nationally or internationally.				
d. Conferences organised by ICT organisations, Ministry of Education, tertiary institutes, etc.				
e. Internship programs, where the teacher spends a few months as an attachment.				
f. Teacher resource centre, which provides professional development materials.				
g. Committees or task forces focusing on curriculum, instruction or student assessment.				
h. Teacher study groups that meet regularly, in face-to-face meetings to further your knowledge in your discipline.				
i. Other forms of organised professional development related to technology. Please specify.				

9. Is there any specific topic in CS that you would like to learn? (Check all that apply)

1. ☐ Operating System
2. ☐ Computer Graphics
3. ☐ Database management
4. ☐ Network
5. ☐ IP technology
6. ☐ Web design
7. ☐ DTP
8. ☐ Online learning
9. ☐ Other, please specify
10. ☐ Not interested in learning anything in CS.

10. Please explain why are you particularly interested in this area of CS?

_____

_____

11. In what mode of teaching would you prefer to learn the above? (Check all that apply)

1. ☐ A few weeks' intensive course
2. ☐ Afew months' attachment
3. ☐ Flexible learning while working
4. ☐ Online courses
5. ☐ More than a year's course
6. ☐ Others, please specify

12. How much training would you require to use the following applications*? (Check all that apply)*

A=extensive. B= A lot. C=some. D=minimal. E=none		A	B	C	D	E
1. Advanced Input/Output Device	Scanner, digital camera, thermal printer					
2. TV/Audio/Video	Educational TV, Laserdisc, VCR, Camera, etc.					
3. Telecommunications	Email, bulletin boards, internet access					
4. Word processing	Word, Word Perfect, ClarisWorks					
5. Spreadsheets	Excel					
6. Desktop Publishing	Pagemaker, Print Shop Deluxe					
7. Instructional Demonstration/ Tutorial	Powerpoint					
8. Information Retrieval	Infotrac, SIRS, Library Circulation, etc.					
9. Networking/Network Management						
10. Web Page Development	Homepage, Dreamweaver, Frontpage					
11. Interactive Video						
12. Curriculum Specific Applications	Eg. For teaching Maths					
13. Basic Operating System Techniques	Mac OS, DOS, Windows					
14. Electronic Research	Online, CD-ROM based, databases					

SECTION 4: TEACHING

13. What grade levels do you teach at present? (Check all that apply)

1. ☐ Form 1
2. ☐ Form 2
3. ☐ Form 3
4. ☐ Form 4
5. ☐ Form 5
6. ☐ Form 6
7. ☐ Form 7
8. ☐ Other, please specify

14. What are your main teaching subjects? (Check all that apply)

1. ☐ Mathematics
2. ☐ Social Studies
3. ☐ Second languages
4. ☐ Physical Education
5. ☐ Vocational education
6. ☐ Special education
7. ☐ Physics
8. ☐ Chemistry
9. ☐ Biology
10. ☐ Accounting
11. ☐ Economics
12. ☐ English
13. ☐ Religious studies
14. ☐ Computing Science
15. ☐ Other, please specify

15. If teaching CS is your mainteaching subject, have you ever learnt how to teach CS at school?

1. ☐ Yes
2. ☐ No

16. If yes, where and how?

_____

17. If no to Q15, how do you manage to teach CS in school?

_____

18. Do you plan to continue teaching CS in the near future?

1. ☐ Yes 2. ☐ No 3. ☐ Not sure

19. If no, do you think that teachers in the CS field should be provided with some incentives to continue teaching CS as their mainteaching subject?

1. ☐ Yes 2. ☐ No

20. If yes, please clearly state what incentives the school, the Ministry of Education, tertiary institutes, businesses, and other stakeholders should provide for teachers in the CS field?

_____

_____

21. How do you classify your teaching post at school?

1. ☐ Regular full-time teacher
2. ☐ Regular part-time teacher
3. ☐ Long term substitute
4. ☐ Trainee teacher
5. ☐ Grant-in-aid teacher
6. ☐ Other, please specify

22. As at the end of 2002, how many years had you been teaching? _____yrs
23. How many students do you teach CS to? _____
24. What is your average class size? _____

SECTION 5: ENVIRONMENT

25. Do you have a computer at home?

1. ☐ Yes 2. ☐ No

26. If yes, please identify the Operating System and the Software that are installed in your computer.

_____

27. Does your home computer have Internet connection?

1. ☐ Yes 2. ☐ No

28. Do you have your own Web page?

1. ☐ Yes 2. ☐ No

29. What is your main purpose of computer usage?

_____

30. How many usable computers does your school own (include servers, personal computers and laptops)?

1. _____ For staff/administrative use only *(no student access)*
2. _____ For student use *(include any use by students, even if staff also use them*)
3. _____ Other, please specify
4. _____TOTAL (should include the sum of 1, 2 and 3)

31. How many usable computers are located in each of the following areas?

1. _____ Classrooms/Instructional rooms
2. _____ Libraries/Media Centres
3. _____ Computer Labs
4. _____ Staff/Administrative offices
5. _____ Other (please specify)
6. _____ TOTAL

32. How many hours does your average student spend on the <u>computer</u> at school in an average week? _____ hours.
33. Does your school have access to the Internet?

1. ☐ Yes 2. ☐ No

34. How many hours does an average student spend using the <u>Internet</u> at school in an average week? _____ hours.

SECTION 6: CHALLENGES IN TEACHING

35. Indicate whether any of the following are barriers to teaching CS at your school.

	Not a Barrier (1)	Minor Barrier (2)	Major Barrier (3)
a) Lack of electricity/ frequent power cuts			
b) Not enough computers			
c) Software applications are very old			
d) The school does not have proper facility to house computers			
e) The computers are obsolete			
f) Computers are frequently out of order			
g) Computer maintenance takes too long			
h) Not enough trained teachers to teach CS			
i) Large classes (more than 40 students at a time)			
j) Not enough CS classes per week to provide guidance to students			
k) Students' attitude			
l) Students don't have no access to computers for practical use			
m) The CS classes we teach are mostly theoretical			
n) Little cooperation from parents and senior staff			
o) Little priority given to teaching CS, e.g. other subjects are often taken during this period			
p) Internet connection is too expensive for students to use			
q) Internet connection is too slow to be useful			
r) Students tend to abuse their Internet access tme, e.g. play games, browse movies and music sites, etc.			
s) Parents have a negative attitude to the school providing Internet access to students e.g. complaints by parents that it allows easy access to pornography.			

36. Do you think that your students will be receptive to varied modes of teaching if proper equipment and resources are available?

1. ☐ Yes 2. ☐ No 3. ☐ Not sure

37. If yes, could you mention what different modes of teaching you could implement in your school.

_____

_____

SECTION 7: CURRICULUM ASSESSMENT

38. Approximately how often do you use each of these applications with your students

Application	Daily (a)	Weekly (b)	Monthly (c)	Once a semester (d)	Never (e)	Not available (f)
1 Computers in general						
2 Word processing packages						
3 Spreadsheets						
4 Databases						
5 Graphical applications						
6 Presentation software (e.g., Power Point)						
7 Desktop publishing						
8 Any Internet activity						
10 Simulation Programs						
11 Drill/Practice Programs, Tutorials						

39. Do you think the students are proficient in the use of the applications that you teach them daily/weekly?

1. ☐ Yes 2. ☐ No 3. ☐ Not sure

40. If no, please state the reasons why they are still not comfortable in using these applications?

41. Approximately what percentage of your teaching method comprises the following?

1. _____% instruction
2. _____% individual exercises
3. _____% group project
4. _____% test
5. _____% assignment
6. _____% others, specify please

42. How do you evaluate your students? (please identify all forms of assessment)

43. Are you using a standard curriculum provided by the Ministry of Education to teach CS?

1. ☐ Yes 2. ☐ No

44. If no, please state the title of the curriculum that you are using presently.

45. How would you rate the current CS curriculum set by the Ministry of Education?

1. ☐ Very effective, there is no need for change
2. ☐ Somewhat useful, but needs to reflect recent developments in the IT field
3. ☐ Not very useful
4. ☐ Ineffective and needs a drastic revision of the whole curriculum.

46. Please state clearly, with reasons, what you find most useful in the present curriculum.

47. Please describe what you want changed and how this could be done in the present CS curriculum.

48. If set questionnaires were provided by the Ministry of Education, would you be able to collect information to evaluate the CS curriculum periodically in future?

1. ☐ Yes 2. ☐ No 3. ☐ Not sure

ANNEX 12: CS PRESCRIPTION

Ministry of Education, Science & Technology

Fiji School Leaving Certificate Examination

Computer Studies Prescription

RATIONALE

In this age of Technology, the computer has the potential of opening a wealth of information for all people. As society becomes increasingly centered on the creation and flow of information, the computer becomes increasingly essential as the primary tool for managing this information. It is essential for the education community to be knowledgeable about the computer, its uses and limitations. The business world is rapidly incorporating the computer in all aspects of its operations. The students leaving Fiji schools will need to be informed about computers whether they will be seeking employment of continuing into tertiary studies.

This prescription assumes that, whether at home or in previous schooling, the students will have had limited opportunities with computers. The course is built to be flexible and provide a wide range of individual and group activities. Computer studies will emphasize the computer as a tool to be used in personal development as well as the world of work.

AIMS

The aims of this prescription are to provide the student with opportunities to:

(a) Become familiar with and understand the basic features of computers.
(b) Develop skills to use the computer creatively.
(c) Develop logic and problem-solving strategies in a variety of situations.
(d) Use the computer and commercial software as a tool in writing (word-processing), and number intensive calculations (spreadsheet)
(e) Explore the social and economic implications of the computer
(f) Become aware of the availability of the information that is electronically stored, updated and manipulated by computers, as well as the potential for the misuse of information about individuals.
(g) Evaluate their own attitudes and values as these relate to possible uses and abuses on computer technology in society.
(h) Become aware of different types of computer related careers and their basic educational requirements.

GENERAL LEARNING OBJECTIVES

The learning objectives of the prescription are to develop and assess the students' ability to:

(a) Set up a personal computer and its peripherals.
(b) Effectively use the basic features of a word processor.
(c) Use a database to process data and information.
(d) Use graphs for effective and graphics presentation.
(e) Choose the most appropriate application tool or language to solve a given problem.
(f) Solve problems by designing and creating simple computer application models e.g. a simple spreadsheet.

(g) Recognize the major hardware and software components of a computer system
(h) Explain the functions of the basic hardware and software components of a computer system.
(i) Define and use correct computer vocabulary when communicating about computers.
(j) Show and understanding of the nature, functions and use of common software programmes.
(k) Discuss the positive and negative impact of computers on society and suggest ways in which the negative impact maybe minimized and the positive impact maximized.
(l) Discuss the future of computers.
(m) Appreciate the role of computer technology in schools, home, business and society in general.
(n) Value the computer as a tool for enhancing learning and efficiency in the education setting.
(o) Become aware of the advantages and limitations of computer technology.
(p) Appreciate the trends and developments in computer and information technology.
(q) Draw simply flow charts to help solve problems.
(r) Demonstrate knowledge of a computer language by writing, debugging and running simple programs to solve specific problems.
(s) Appreciate the value of hardware and software and the importance of maintaining them in a suitable manger.
(t) Be wary of the dangers of incorrect use of handling computers and their peripherals.

COURSE CONTENT

[Note: The T and P extensions designate Theory and Practical units respectively. The prescription assumes at least 200 minutes (or 5 40-minute periods) of instruction each week divided between theory and practical. Units 1 though 3 to be taught the first year. The second year concentrating on Units 4 through 6.]

Form Five and Six

Unit 1- T: Structure and Functions of a Computer.

Aim: To enable the student to understand the basic parts of the computer, their use and care.

Content:

1T.1 Major functions and parts
Input, Output, Storage, Central Processing Unit, Memory, Floppy Disk Drive,Hard Disk Drive, Monitor, Keyboard, Mouse, Printer.

1T.2 Types of Computers
Micros, Minis, Mainframe, Super Computers

1T.3 Operating Systems
Purpose, DOS.

1T.4 Application Software
Word Processing, Spreadsheet, Business, Games, Typing, Tutors, Inventory.

1T.5 Limitations of Computers

Unit 1-P Using the Computer

Aim: To help the student become proficient in using the computer.

Content:

1P.1 Guidelines for care of the computer
Proper working environment, care of floppy disks, cleaning disk drive, use of printer.

1P.2 Keyboard Skills
Use of keyboard tutor program to increase keyboard skills.

Unit 2T: History of Computers

Aim: To provide the student with information on the development of computers from the earliest days until today.
To enable the student to understand that innovations (inventions)and development of new technologies came about in response to the needs of society.

Content:

2T.1 History and Development of Information Processing, computer hardware, computer software, information systems, data, data entry, data bases, data processing, output.

2T.2 Applications of computers in various fields e.g. education, medicine, law and law enforcement, economics, airlines, government, insurance, art and music.

2T.3 Latest trends in Computer Usage

Unit 2P: Word Processing

Aim: Students should have the ability to produce letters and reports using a word processor.
Students should be able to input text using a keyboard at a sufficient rate.

Content:

2P.1 Keyboard skills development using appropriate software

2P.2 Retrieving and saving a document

2P.3 Creating a document

2P.4 Printing a document

2P.5 Document editing.
- Display existing document
- Moving the cursor
- Strike over (type over) text
- Insert text
- Delete text
- Move text
- Copy text

2P.6 Advanced word processing skills
- Centre text
- Underline text
- Bold text
- Indent text
- Search and replace text
- Use a spelling checker
- Use fonts and graphics

Remarks: This unit may be used to create documents for other subjects e.g.English, History etc.

Unit 3T: Computers and Information Processing

Aim: To assist the student to recognize how the computer can manage, store and retrieve vast amounts of information.

Content:

3T.1 Information

Definition, Use in Business, Banks, Libraries, government

3T.2 Information Retrieval

File, Records, Field, Database

3T.3 Managing Information

Fields, Records, Sorting, Searching, Boolean Logic

Unit 3P: Information Processing

Aim: To provide opportunities for the student to actively engage in information processing.

Content:

3P.1 Using an existing database
Searching records, sorting records, print formats, printing requested **information.**

3P.2 Creating a database
Develop a simple database (i.e., library books, video rentals, student records, school inventory.

Unit 4T: Programming

Aim: To familiarize the student with the tools and techniques of programming.
To introduce the student to the BASIC programming language.

Content:

4T.1 Languages
Machine Language, Compiled Language, Interpreted Language, LOGO, BASIC.

4T.2 Program planning
Problem specification, decomposition and algorithm designs

4T.3 Programming Language – BASIC
BASIC, commands: DELETE, EDIT, FILES, LIST, LLIST LOAD,"RENUM, RUN, SAVE" SYSTEM
BASIC keywords: CLS, END, FOR….NEXT, GOSUB….RETURN, GOTO, READ, DATA, IF, INPUT, LET, PRINT,REM.

4T.4 Data types
Numeric, alphabetic and alphanumeric

4T.5 Arithmetic operators
Addition, subtraction, multiplication, division, exponentiation, order of operation.

Unit 4P: Programming

Aim: To enable the students to write simple structured programs in BASIC
To develop debugging skills in the student.

Content:

4P.1 Writing simple structured programs in BASIC, entering the program into the computer, saving the program, loading the program.

4P.2 Subroutines and parameters
FOR……NEXT,GOSUB…..RETURN,

4P.3 Predicting output
Output and its layout (format).

4P.4 Debugging and correcting syntax errors, finding and correcting errors in program logic.

Unit 5T: Computers in Society

Aim: To study the present and potential uses and significance of computers in society.
Be able to discuss the psychological, organizational, ethical and legal issues arising from the introduction of computers.

Content:

5T.1 Computerization of Society
5T.2 Privacy of information
5T.3 Computer-based crime, hacking
5T.4 Computer security
5T.5 The computer virus

Unit 5P: Spreadsheet

Aim: The student will understand the purpose of the spreadsheet and its application in a variety of tasks.
The student will create and use simple spread sheets.

Content:

5P.1 Entering information
- Enter text in a cell
- Enter a number in a cell
- Enter a formula in a cell
- Adjust column width
- Insert columns or rows
- Save and retrieve a worksheet

5P.2 Using information
- Make a copy of a range of cells
- Move a range of cells in a work sheet
- Sort a range of cells
- Format a range of cells
- Print a work sheet

5P.3 Creating graphs
- Create and view a graph
- Save a graph for later printing
- Print a graph

5P.4 Data query
- Select specific information
- Modify selection criteria

Unit 6T: Computers and Careers

Aim: To investigate the use of computers in fields apart from computing.
To introduce the students to the concepts of networking and data communications.
To investigate the work of computing professionals.

Content:

6T.1 Computers in Other Fields
Research using CD-ROM, Music with MIDI, Writing/Composition, Foreign Languages, Art, Computer Simulation, Mathematics, Robotics, Artificial Intelligence, Drafting using CAM/CAD, machining using Numerical Control.

6T.2 Data Communication and Networks
6T.3 Management Information Systems (MIS)
6T.4 Jobs in Computing
- MIS Manager
- Operations Manager
- Programmers
- Analyst
- Librarian
- Data Entry Operations
- Salesman
- Technician
- Trainer/Educator etc.

6T.5 Career path of computing professionals.

Unit 6P: Intermediate Concepts and Optional Applications

Aim: To expose the students to computer applications
To familiarize the student with commonly used DOS commands.

Content:

6P.1 DOS commands
DIR, FORMAT, CHKDSK, COPY, RNAME, ERASE
DISK COPY, DATE, TIME, CLS, MKDIR, CHDIR, RMDIR,
TYPE, PRINT, MORE, REPAIR, RESTORE, VER, PROMPT,
AUTOEXEC.BAT, CONFIG.SYS.

6P.2 Education Software

6P.3 Desktop publishing, Graphics, Graphics User Interface (GUI)

EVALUATION

a. INTERNAL ASSESSMENT

a.1 The practical assessment will weighed 30% of the total score. The teacher will maintain a file of the student's assignments on the Practical Units during the two year course of study. Word processing and spread sheet will each be 10% of the score. Programming and other applications will each be 5% of the practical score.

b. EXTERNAL EXAMINATION

b.1 There will be a three hours written examination at the end of the two year course of study.

b.2 The written examination will account for 70% of the total score. The examination will include questions that will test the specific objectives. Questions will be derived from the following categories.

Multiple choice
Short paragraphs
Determining the outputs of computer programs
Debugging simple computer programs
Structured programming

b.3 Each of the units within the prescription will be examined and the maximum marks attributable to each will not normally exceed:

Unit	1T	Structure and Function	8 marks
	1P	Using the Computer	10 marks
	2T	History of Computers	5 marks
	2P	Word Processing	10 marks
	3T	Computers and Information	5 marks
	3P	Information and Processing	10 marks
	4T	Programming Methods	5 marks
	4P	Writing Programs	10 marks
	5 T	Computers in Society	7 marks
	5P	Spreadsheets	10 marks
	6T	Computers and Careers	10 marks
	6P	Intermediate Concepts	10 marks

WEIGHED TOTAL 70%

POSSIBLE SUBJECT COMBINATION INCLUDING COMPUTER STUDIES

Science Track

Two of the three sciences
[Biology, Chemistry, Physics]
English
Maths
Computer Studies

Arts Track

English
Maths (optional)
History
Geography
Computer Studies

Business Track

English
Maths
Accounting
Economics
Computer Studies

General/Vocational Track

English
Maths (optional)
Clothing/Textiles } for
Food/Nutrition } girls
Wood Technology } for
Engineering } boys
Computer Studies

IMPLEMENTATION GUIDELINES

Computer education is a relatively expensive exercise which demands careful planning at the outset. It requires good management of both physical and human resources to ensure the implementation and maintenance of a meaningful and beneficial computing Programme. This is even more important in the light of the numerous constraints currently faced by schools and their managements.

The purpose of the following guidelines is to inform all concerned of the many facets of computer education. Plans for school programmes must take into account the changing nature of computer technology. This means that allowances must be made to suit the demands of changing circumstances. Lastly, if a school is to properly manage, organize, and budget for computer education, it is essential that those making decisions in these areas have some awareness of the needs, scope, rationale, and issues of mounting an examinable computer studies course.

1.0 Hardware

1.1 Minimum Configuration

The recommended minimum configuration for computer hardware is as follows:

386SX processor, 25 MHz
4 MB-memory
40 MB-memory
3.5” 1.44 MB floppy drive
Color VGA screen
MSDOS 5.0
Mouse

This minimum configuration will be assessed on a regular basis in relation to the current situation.

1.2 Purchase

When buying on their own, schools are advised to consult the Computer Education Centre (CEC) if they are not certain about how and what to purchase. Normally, vendors will install computers at the site.

1.3 Support and Repair

While it is not possible for the CEC to provide support services for hardware, schools will depend on outside vendors for support. Schools are therefore advised to be assured of hardware support by vendors that they purchase from.

1.4 Replacement Policy

Computer equipment is different from most other hardware in the speed at which it becomes obsolete. By its nature, there is little value in teaching computing with outdated systems. For these reasons, it is important that schools consider and adopt a policy that will ensure that replacement of computers on a regular basis.

After five years at the very outside, maintenance costs will be unreasonable high in

relation to the cost of the computers. Thus computer replacement will be required, and funding for this should be built into any budget of future programme costs. Old computers could be sold at auction to recoup some of the cost.

1.5 Power Supply

Equipment providing adequate power protection should be installed with the computer hardware to insure good quality electrical power thus protecting the computers from premature failures. This probably means that in most areas served by FEA, a simple filter that removes electrical spikes will be sufficient. Where power is supplied by a generator, full voltage stabilization will be necessary. Uninterruptible power supplies which provide continued operation in the event of a power failure are not recommended. The additional expense of this equipment cannot be justified.

2.0 Software

2.1 Purchase

The CEC will assist by purchasing shareware and freeware which can be distributed freely to schools. It will also evaluate software and recommend them to schools. Schools are encouraged to purchase software on their own. The purchase of any prescribed software will be a school's responsibility unless otherwise stated by the ministry.

2.2 Licensing

Buying software usually means purchasing the license (or right) to use the software on one computer. Schools are advised that all software used should be properly purchased and licensed. This enables the provision of manuals and additional copies of software.

3.0 Computer Room

A separate and well equipped computer room will facilitate student learning, classroom organisation, and proper care for the computers. A room for storage is essential and a white board is recommended to prevent dust. Air conditioning helps in maintaining the life of the machines. Should needing help on the layout or set up of a computer room may seek help for CEC.

4.0 Ratio of Students per Machine

The maximum number of students per machine in a computer class is two (2). This ratio is necessary to insure that students have sufficient time to interact with the computer.

5.0 Time Allocation

5.1 A minimum of five (5) 40 minute periods per week

5.2 The recommended minimum time allocation for each unit is as follows:

Unit	1T	Structure and Function	3 weeks
	1P	Using the Computer	5 weeks

2T	History of Computers	2 weeks
2P	Word Processing	11 weeks
3T	Computers and Information	3 weeks
3P	Information Processing	7 weeks
4T	Programming Methods	2 weeks
4P	Writing Programs	7 weeks
5T	Computers in Society	2 weeks
5P	Spreadsheets	11 weeks
6T	Computers and Careers	3 weeks
6P	Intermediate Concepts	6 weeks
	Total	**62 weeks**

ANNEX 13: Symposium Programme

Symposium on Evaluation of Computer Science Curriculum in Fiji Schools

Date: 27th – 28th March
Venue: USP Bure
Organizer: ICT Capacity Building @ USP Project

Objectives:

- Share the results of the research entitled "Evaluation of CS Curriculum in Fiji Schools";
- Collect qualitative data from symposium participants'arising from their reflections, group brainstorming, and many discussions;
- Develop recommendations as identified by the participants for a model curriculum;
- Establish some networking channels amongst the participants;
- Raise the profile of the ICT Research component specifically and ICT Capacity Building @ USP Project generally.

Expected Outcomes:

- Clearly defined recommendations;
- Incorporation of the qualitative data into the final report;
- Networking channels defined for linkages between CS teachers, schools, Ministry of Education and other stakeholders.

PROGRAMME

27th March

8.30-8.35	**Welcome and Introduction** Dr Esther Williams USP Librarian & Primary Researcher
8.35-8.50am	**Mr. Tomobe** JICA Resident Representative
8.50-9.30am	**Opening Speech** Mr. Joe Natao Director – Technical & Vocational Department, Ministry of Education
9.30-10am	Participant Introduction
10-10.30am	Refreshments
	USP/JICA Project's activity
10.30-11am	**Overview of the ICT Capacity Building @ USP Project** Ms Maki Kato – Coordinator – ICT Capacity Building @ USP Project & Primary Researcher
11-11.30am	**Open Source Learning** Ms Veronica Schiaffini CS Lecturer – USP
11.30-12pm	**JICA Expert – Multimedia Database** Mr Wade Miyagi - Distance and Flexible Learning Expert - USP

12-1pm	**Ministry of Education – IT Section situation** Mr Viliame Draunivesi Education Officer – Technical and Vocational Section, Ministry of Education	
1-2pm	**Break**	
2-2.30pm	**Introduction to the Research Concept** Dr Esther Williams, Ms Kato and Ms Malik	
2.30-3.30pm	**Research results** Dr Esther Williams Ms Maki Kato Ms Natasha Malik	
3.30-4pm	**Refreshments**	
4-5pm	**Research results – continued**	
6pm	**Banquet Dinner – Hai Kong Seafood Restaurant**	
28th March		
8-8.30am	**Model of a Successful School (Vanua Levu)** Mr Drivendran Sami CS Teacher – Labasa Sangam College	
8.30-9am	**Model of a Successful School (Viti Levu)** Mr Yogesh Mani Head of Math and Computing Department - Nadi Muslim College	
9-10.30am	**Towards a Model Curriculum** Mr Ron Keesing CS Lecturer - USP	
10.30-11am	**Refreshments**	
11-1pm	**Brainstorming**	**Facilitators**
	- Networking	(Natasha Malik)
	- Training/Equipment/Strategies of access	(Edo Stork)
	- Job Security for CS teachers	(Viliame Draunivesi)
	- How to improve assessment	(Veronica Schiaffini)
	- CS curriculum	(Ron Keesing)
	- Self training	(Christopher Robbins)
1-2pm	**Break**	
2-4pm	**Presentations by individual groups**	
4-4.30pm	**Refreshments**	
4.30-5.30pm	**Finalizing Recommendations**	
6pm	**Closing Speech – Professor Fuji Takahashi**	

ANNEX 14: Ministry of Education Definitions

Teachers' Categories

Grant-in-Aid (GIA)
A GIA teacher is one who is teaching in an aided school and whose salary is met by government. An aided school is a non-government secondary or junior secondary school receiving grant-in-aid either in cash or kind from the government.

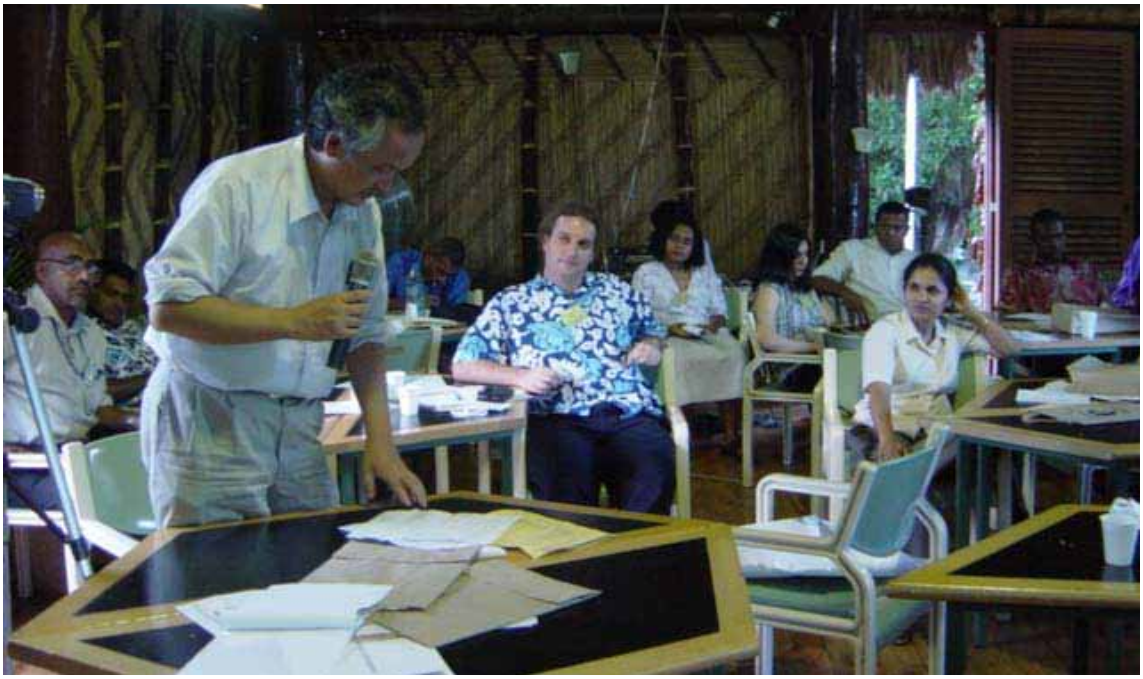
Temporary Civil Servant (TCS)
A TCS is one employed by the Ministry whose salary is met by government for a period depending on the need of schools.
The employment is renewable every year by the recommendation from the Principal.

Civil Servant (CS)
A Civil Servant is one employed by the Ministry and the employment is permanent.

Salary wise there is no difference between GIA and TCS. There is no maternity reliever for a GIA but the Ministry provides a maternity reliever when a TCS (who has served for 2 years) goes on maternity leave.

TCS can act in a vacant HOD position. A GIA can act in the position without any remuneration. For promotion, all have equal chances.

Minimum required qualifications
To teach as a Secondary School teacher, a diploma in education from Fiji College of Advanced Education (FCAE) or degree with teacher training is the minimum requirement. In some instances, a person may be employed who has only degree but no teacher training.



Closing speech by Professor Fuji Takahshi