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Enhancing Students' Skills Through Technology (ESST) : a one-to-one computer solution at Fiji National University

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Enhancing Students' Skills Through Technology (ESST)" : a case study conducted for a policy concept on one to one computer solution at Fiji National University

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ABSTRACT

Fiji National University has come a long way from its time of inception in terms of information and communication technological resources and capabilities. Achievement of its primary responsibility of human capital development depends largely upon its teaching and learning resources. Research has confirmed that ICT has significant potential to assist students who are currently disadvantaged by gender, disability, ethnic and socio economic background. Total student population of the FNU comprises of 75% students who are basically from lower income families of which the annual income is lower than FJD 15,000/=. Therefore, majority of the students do not have their own computers and as a result, libraries and computer labs in the university are very competitive and fully occupied even at nights. Thus, FNU is compelled to use a model which explain how that potential can be developed and used to benefit students currently seen to be excluded from, underachieving in, or disaffected by university. As it is evident to develop the skills needed for 21st century, provision of ICT and enhanced information literacy skills through SDL are exclusively needed. FNU has already introduced information literacy as a mandatory course to all students of the university through its COM 501: Information and Communication Literacy. Thus the only gray area of the mission is the provision of ICT facilities to develop HOT skills of students through SDL. This paper discusses the potential models which can be used for implementing 1:1 computer provision in a university library setting.

Keywords: HOT skills, one to one computer, Self-Directed Learning, computer literacy, Information Literacy, Fiji

INTRODUCTION

Fiji National University (FNU) is one of the fastest growing universities in the Oceania region. Its EFTS (equivalent Full Time Student population) has grown from 12,255 in 2010 to 13,439 by 2012. The number of courses offered also has grown from 198 in 2010 to 548 in 2013. In the day and age that FNU is

functioning today, it is facing dynamic and challenging environments with increasing severity every day. In present day the political, social, economic and technological changes are as such where most systems are rendered obsolete within the first year of their very implementation. In the said conditions and situations, the university student faces challenges of unprecedented nature. It becomes the paramount role of university policy maker to equip the student with skills and competencies that are capable of accepting the challenges and facing them successfully in order to emerge a victor. Also, it is vital to promote the appropriate use of technology to assist all students so that they can become more independent, self-confident, and productive learners.

The teacher and student are responsible for taking charge of their own learning. Technology allows the opportunity to rethink how teaching and learning is done in educational institutions. One of the significant highpoints seen in FNU curriculum is promoting Self-Directed Learning (SDL) by which the students select, manage, and assess their own learning activities, which can be pursued at any time, in any place, as a core aspect of its curriculum. The integration of ICT in learning and teaching helps to create environments which enable all students to become confident and self-directed learners. When used well, ICT enriches learning and enhances teaching. It is a powerful motivational tool for students and it increases the scope and opportunities for learners in the knowledge era. This is a learner-centered model, based on the individual preconditions and needs of each student facilitating learners to go with different pathways of self-directed learning. Work and knowledge in the rapidly developing 21st century call for self-directed learners (SDL) with Higher Order Thinking (HOT)[1] and Information Literacy skills to face for the indispensable requisites of the new knowledge era to be abled citizens..

While increasing the ICT facilities which can catalyze the paradigmatic shift in SDL, it is important to develop information literacy skills of students because it is a critical academic component which leads to Higher Order Thinking (HOT) that in turn becomes lifelong learning, transferable across all educational disciplines and applies to all avenues of life. Information literacy is a basic requirement and an essential skill for the modern day academicians. In the absence of such, the said academicians will be left behind in the ever competitive environment. Paradoxically, the large volume of information on the Web made self-directed learning harder and awkward. This is one of the findings of Project Information Literacy - a project

[1] Higher-order thinking is the ability to think beyond rote memorization of facts or knowledge. Rote memory recall is not really thinking. Higher order thinking skills involve actually doing something with the facts that we learn. When students use their higher order thinking skills that means they understand, they can find connections between many facts, they can manipulate them, and put them together in new ways. Most importantly they can apply them to find new solutions to problems.

which studied the challenges that real users face when conducting both school-related and “everyday life” research. Based on examining research habits of thousands of students, it was able to distill several prominent components that learners consistently find laborious when conducting independent learning and research. This includes understanding what is important to know about a particular topic in the first place, what are the important questions to ask, and where to begin. Another group of researchers (Butcher & Sumner, 2011) refer to this challenge as the "sense making paradox". Self-directed learners face a sense making paradox: they must employ deep-level thinking skills in order to process information sources meaningfully, but they often lack the requisite domain knowledge needed to deeply analyze information sources and to successfully integrate incoming information with their own existing knowledge.

Thus, it is apparent that the universities must have common goal to build students' higher-order thinking skills through information literacy with the provision of ICT enabled SDL, yet many institutions fail to merge the necessary resources and expertise into a cohesive strategy. Thus it is evident that issues and challenges of ICT in education should be given urgent and adequate attention to achieve a grater solution to engrave the capabilities of students in a manner which suits to the 21st century.

Taking into consideration the existing figures of the FNU, following tables provide an overview of the campuses with their EFTS, student headcounts, and student PCs in 2012:

Table 1- EFTS by Campus, 2012

Campus	EFTS	Campus	EFTS
Nasinu Campus	2,251	UniStudio Campus	227
College of Medicine, Nursing & Health Sciences	2,083	Hospitality & Tourism Campus	220
Samabula Campus	1,976	Maritime Campus	161
Lautoka Education Campus	1,803	School Venues (Franchise)	84
Namaka Campus	936	Nabua Campus	46
Labasa Campus	609	Nadi Aviation	29
Koronivia Campus	604	Vatuwaqa Printing	12
Ba Campus	346	Rakiraki	1
		NTPC	2,051
Total EFTS 13,439			

Table 2 – Student Headcounts

College / Centre	Headcounts
College of Business, Hospitality & Tourism Studies	6,898
College of Engineering Science & Technology	5,778
College of Humanities & Education	2,650
College of Medicine, Nursing & Health Sciences	2,084
College of Agriculture, Fisheries and Forestry	665
NTPC	12,585
Total Headcounts	**30,660**

Table 3 – Student PCs by Campus, 2012 and 2013

Campus	2012	2013	Campus	2012	2013
Labasa	91	110	Sigatoka	16	16
Rakiraki	27	27	Nasese	37	37
Ba	88	79	Raiwai	61	61
FSM Lautoka	23	23	Maritime	38	38
Naceva	16	16	Nabua	106	106
Naviti	73	73	Nasinu	314	353
Natabua	122	122	Narere	107	107
Namaka	26	36	Koronivia	48	71
Nadi	310	382	Nursing	51	93
Samabula	474	474	Tamavua	49	49
Pasifika	94	106			
Total (in 2012) - 2,171; (in 2013) - 2,379 (+9.5%)					

Student (EFTS) to PC ratio has recorded good growth from 2012 to 2013, as table below shows:

Table 4 – EFTS / PC, 2010 - 2012

Description	2012	2013
EFTS (est.) / PC	6.1	5.6
% growth over previous year		18.8%

Table 4 indicates that the FNU has achieved a significant growth in terms of EFTS/PC ratio.

ISSUES/SHORTCOMINGS PREVENTING FNU ACHIEVING HIGH DEGREE OF IT ENABLED SDL PERFORMANCE

Fiji National University has come a long way from its time of inception in terms of information and communication technological resources and capabilities. Achievement of its primary responsibility of human capital development depends largely upon its teaching and learning resources. However, the existing system at FNU does have some absences which need close and urgent attention enabling the university to

achieve highly performed and skilled graduate outputs. While FNU has embraced the types of pedagogies that foster SDL skills in graduates, the pace of change in technology can be glacial. Thus, it has been difficult to adequately perform and complete assignments/projects and other SDL related activities given the limited access to computers and technology. Consequently the benefits of ICT integrated learning facilities will provide students and teachers with the skills necessary to meet the targets of FNU's 2020 strategic plan

Research has confirmed that ICT has significant potential to assist students who are currently disadvantaged by gender, disability, ethnic and socio economic background. Total student population of the FNU comprises of 75% students who are basically from lower income families of which the annual income is lower than FJD 15,000/=. Therefore, majority of the students do not have their own computers and as a result, libraries and computer labs in the university are very competitive and fully occupied even at nights. Thus, FNU is compelled to use a model which explain how that potential can be developed and used to benefit students currently seen to be excluded from, underachieving in, or disaffected by university.

FNU has installed wireless network, but little utilized because of less number of portable computers which belong to current students. Also personally owned computers do not have the appropriate software due to licensing limitations and prohibitive cost. Day to day instruction still relies heavily on black and white handouts, conventional lecture notes, textbook etc. Students' learning needs are not always met through this traditional pedagogy and it seems that FNU's educational model is relatively conventional and it has not been integrated ICT significantly with the current global trends in the education sector. Thus, it appears that we are preparing our students for the industrial world, a world which we left behind long ago, and a world in which change was glacial. The way we gather, transmit, and share information is changing constantly and rapidly, so if we are going to engage students, we are going to have to focus on some different communication methods, evolving our teaching practices with the technology as it evolves. We should not deliver knowledge but we have to help our students make sense, repurpose, remix, interpret and generate wisdom which comes from Higher Order Thinking.

As it is evident to develop the skills needed for 21st century, provision of ICT and enhanced information literacy skills through SDL are exclusively needed. FNU has already introduced information literacy as a mandatory course to all students of the university through its COM 501: Information and Communication

Literacy. Thus the only gray area of the mission is the provision of ICT facilities to develop HOT skills of students through SDL. For the provision of increased access to ICT, we need to estimate the actual PC demand of the university for coming years.

ESTIMATING STUDENT COMPUTER DEMAND

The growth in number of student PCs has to outpace the increase in EFTS in order to ensure improvement in EFTS / PC ratio. Further, computers close to or at the end of their useful lives also need to be replaced, adding to the investment required just for maintaining the existing EFTS / PC ratio. It is estimated that almost 20% of all PCs need to be retired every year (PCs have useful life of around 5 years).

EFTS is proposed to be used as the key planning parameter, as the demand and usage of a PC is directly linked and proportional to the extent of a student's time invested in learning and research. In other words, the PC time demanded by one EFTS would be four times that demanded by a student enrolled in only one-fourth of the courses required to be considered a full-time student.

FNU plans on having 57,000 student headcounts by 2020. At current Headcounts / EFTS ratio of 2.28 (30,660 / 13,439), this translates into 25,000 EFTS in 2020, or, 8% year-on-year growth from current levels. Table below brings out additional student PCs required in 2014, taking into account the following:

1. Growth in EFTS (8% year-on-year);
2. Replacement of end-of-life PCs (assume 20% of 2,579 i.e. 515, say, 500 PCs); and
3. Improvement in EFTS / PC ratio from 5.6 in 2012 to 1.00 in 2014.

Table 5 – Student PCs, 2012 – 2014

Year	EFTS	PCs	Additional PCs required	EFTS / PC
2012	13,439	2,171		
2013	14,514	2,579		
2014	15,675	15,675	13,596 *(15,675 – 2,579 + 500)*	1.00

We are looking at over 13,600 additional PCs to be purchased in 2014 for facilitating ICT related learning enabling students to gain 21st century literacies as the knowledge is ever changing in the world. This has been clearly supported by Arthur C. Clarke saying *"How can it be, in a world where half the things a man knows at 20 are no longer true at 40 -- and half the things he knows at 40 hadn't been discovered when he was 20?"*

POLICY CONCEPT

It is proposed hereby to enhance ICT facilities in order to increase student access to ICT that supports Self Directed Learning to develop IL and HOT skills of students.

GOAL

To be the leader in ICT based learning environment in the South Pacific enabling the FNU students to develop their IL and HOT skills through SDL to successfully face for the 21st century.

Providing high end ICT facilities will ensure accessibility only. There is no guarantee that the desired outcome of students actually using the facilities could be achieved without a structured programme targeted at achieving this goal.

OBJECTIVES

By January 2014

1. To establish an ICT based learning environment at FNU
2. To enhance students' skills in information and communication technology in order to develop IL and HOT skills in an ICT based learning environment
3. To train the trainers for each department who is capable of delivering training on basic skills of learning in ICT based learning environment
4. To establish a peer education programme, with peer leaders who are trained in supporting the students in achieving the basic ICT skills to continue learning in the ICT based learning environment
5. To set up a reward scheme for best students who master the ICT skills

SUPPORTING EVIDENCE TO IMPLEMENT THIS POLICY RECOMMENDATION

Bloom's Taxonomy, developed in the 1950's which was revised later, expresses thinking and learning through a set of concepts that begin with lower order thinking skills (LOT) and build to higher order thinking skills (HOT). In education, quality teachers seek to bring their students to the HOT level of the taxonomy whenever possible. Acquiring knowledge and even comprehending information pale in comparison to being able to apply that knowledge. In addition, as additional ideas come forward, the complexities that emerge demand further analysis of the information, etc.

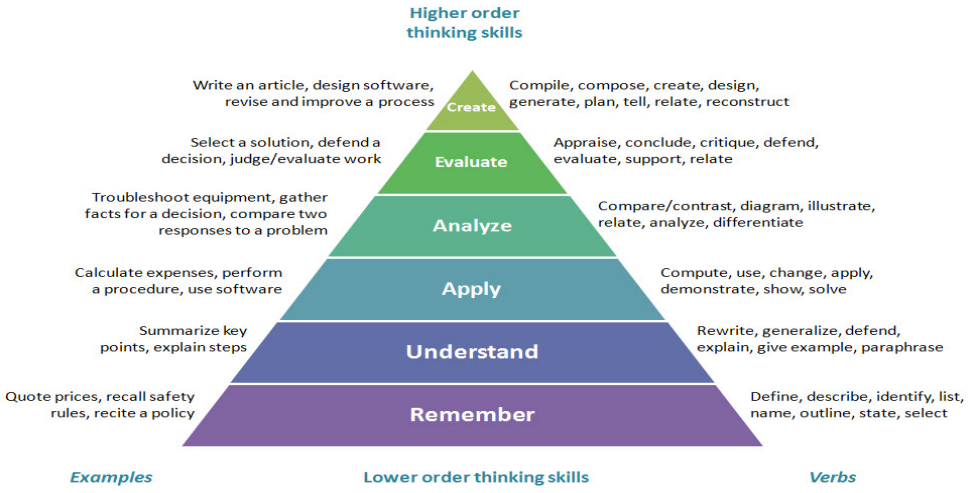

Figure 1: Bloom's Taxonomy

But today's educational landscape is vastly different from that of yesterday rendering a lack of clarity as to where the levels of the taxonomy fit. As education heads into the digital world, many teachers struggle with where to place many of the new technology tasks within this long-standing hierarchal guide to teaching and learning. Bloom's Digital Taxonomy was emerged because of the need of these technical advancements.

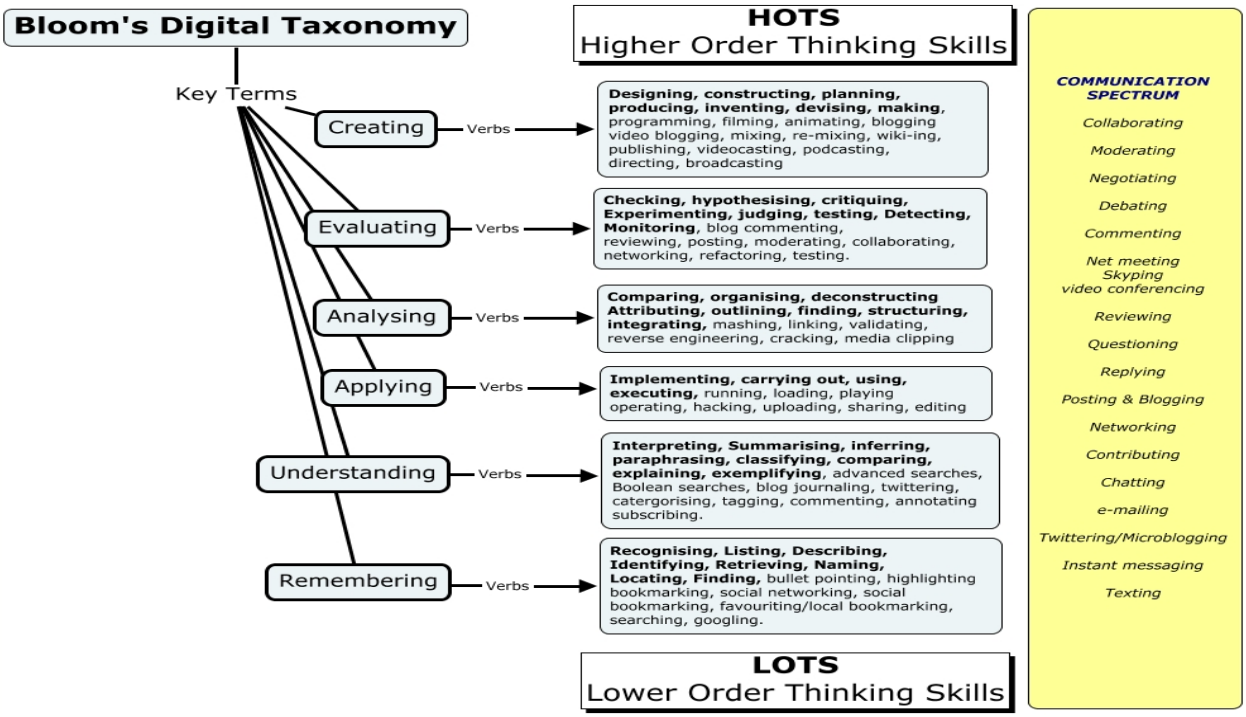

Figure 2: Bloom's Digital Taxonomy

As this digital taxonomy points out collaboration plays a critical role to the learning process in the digital world. It is commonly used when developing Higher Order Thinking skills such as Analyzing, Evaluating and Creating using some information and communication technologies such wikis, blogs, classroom discussion boards, Google docs, and social media tools. Teachers can critically think about how Bloom's Digital taxonomy can assist students in creating an engaging, interactive and motivational learning environment. Trilling and Fadel (2009) states that "to be productive contributors to society in our 21st century, you need to be able to quickly learn the core content of a field of knowledge while also mastering a broad portfolio of essentials in learning, innovation, technology, and careers skills needed for work and life" (p16).

It needs constantly trying to push students to use higher levels of thinking in encouraging them to apply knowledge, add on to knowledge, and evaluate. "Bloom's Digital Taxonomy" gives ideas to use higher level thinking in studies and it is not just important for the students to know how to use the technologies, but also to use analyze, synthesize, and evaluate their work when doing this. The students will be using search engines, Google docs, and will evaluate information that they find. Some of these rubrics will be helpful for

the students to see what they should really be doing when researching, and maybe they won't just use the first piece of information that they find. This develops the 21st Century Skills that we expect from any student in the new global economy such as Critical Thinking and Problem Solving, Creativity and Innovation, Computing, IL and ICT Literacies etc. Predominantly, the SDL contributes to accomplish these skills in students who are preparing to face for the global market requirements immensely. Longitudinal studies indicate that the full integration of ICT into technology learning changes the nature of learning, creates more independent and self-directed learners, encourages the use of multiple learning methods, and encourages team oriented inquiry. The self-paced environment is beneficial for all types of learners because it allows students to take responsibility for their own learning while also moving at their own speed. Learning is enhanced when students are internally driven rather than receiving external motivators.

Warschauer (2005) points out that the most obvious benefit of ICT based learning is to prepare students for the challenges that they will face in the 21st century. These challenges include IL and HOT skills. Students will take more ownership in the process by spending more time creating a quality product that requires a variety of learning activities. Online tools such as blogs, podcasts, and social networking when completing assignments and curriculum work enable the opportunity to try new things and personalize learning and applications to student interests, thus connecting with where students are. Even without teachers using technology an instructional tool, students being Self-Directed Learners can gain by using personal technology as a powerful learning and organizational device. Some of the key ways it can be used by students include: Production: Students can use personal technology for note□taking, writing, problem□solving, projects and portfolios. Storage: Students can use personal technology to store notes, documents, photos, screenshots and other essential information on their device, or better yet, in the cloud. Sharing: Students can use personal technology for collaboration and communication inside the classroom and beyond. Research: Students can discover answers or access information, real□time, in□class or at home. This mirrors how the world operates in the 21st century. Access: Students can access all information anytime and anywhere. The backpack, textbooks and the locker will decline in importance, as all documents, data and information become accessible via personal technology. Flexibility: Students now have many new means of learning. The learning environment is expanded and altered. Students have more forums through which to communicate, with peers and their teachers, inside and outside of the university.

The world is now going paperless. Electronic communication is making the US Mail service irrelevant. Complicated communication tasks are now taken care of without paper. Since 2012, Amazon has sold more e□books than paper books. The move to a paperless exchange of data does not dramatically alter how teachers teach and how students learn, but it does simplify how students and teachers exchange and store, analyse and interpret information. Thus, it is evident that the provision of technology for SDL is needed to develop the required skills of students in the 21st century.

Following table 6 summarises the strength of evidence for findings from systematic and non-systematic reviews and a large 1:1 project named RED used in a meta-synthesis, which indicates that 1:1 computer initiatives often have goals for student outcomes beyond traditional achievement. The existing research has strongly supported the conclusion that technology use increases when 1:1 initiatives are enacted in terms of developing HOT skills and computer literacy.

Table 6: Evidence and strength of findings by domain for impact of 1:1

	Systematic (S) Reviews	**Non – Systematic (NS) Reviews**	**Project RED**	**Strength of Findings**
Student Outcomes	Using standardized tests, effect size for writing small to medium (*g* = .31-.35) and negligible to small (*g* = .01-10) for other academic areas assessed through standardized tests.	Survey information shows that teachers often believe 1:1 improves student achievement, especially in the area of writing. Higher graduation rates and increased enrollment in upper level and dual enrollment courses also mentioned.	Properly implemented 1:1 technology results in higher test scores and higher rates of course completion, dual enrollment, graduation, and college attendance	S Reviews (4) NS Reviews (1) Project RED (1) **Total = 6**
	Student development of research, organization, and resourceful skills weakly supported; development of collaboration skills moderately supported	Students are better organized and more skilled at research.	Not addressed	S Reviews (2-3) NS Reviews (2) Project RED (1) **Total = 5.5**
	Improved student attitudes towards technology, teacher-student relationships, and parent	Increased level of student engagement and student motivated to do better quality work. Students edit	Properly implemented 1:1 technology results in fewer disciplinary actions and lower dropout rates.	S Reviews (3) NS Reviews (2) Project RED

	communication moderately supported.	their work more frequently.		(1) **Total = 6**
	Greater technology usage and literacy strongly supported but without a reliable estimate of the size of the effect	Students appear to use computers for a greater variety of purposes and these purposes appear to involve Higher Order Thinking (HOT) or initiative.	Properly implemented 1:1 technology results in student daily use of technology for online collaboration and search engines.	S Reviews (4) NS Reviews (2) Project RED (1) **Total = 7**
Professional Development and Implementation	Professional development involving teacher beliefs and concerns, hands-on training, and technical support that results in more learner-centered practices is weakly to moderately supported.	Professional development is critical to the success of 1 to 1 initiatives. Professional learning should include technology skills that are anchored in the specific contexts of teaching and learning, and aligned with curriculum and standards.	In properly implemented 1:1 technology initiatives leaders provide time for teacher professional learning and collaboration at least monthly.	S Reviews (2-3) NS Reviews (2) Project RED (1) **Total = 5.5**
	Leadership that positively impacts teacher and student practices through actions such as community consensus building, providing layered technical support, and monitoring morale is weakly supported.	Leadership is a key component of effective 1:1 initiatives along with having a shared vision that guides the program and is communicated with all stakeholders.	In properly implemented 1:1 technology initiatives principals are trained in change management that includes teacher buy-in, best practices, and technology-transformed learning.	S Reviews (2-3) NS Reviews (2) Project RED (1) **Total = 5.5**
	That learner-centered teaching will improve 1:1 implementation and/or be a result of 1:1 implementation is moderately supported.	Less large group instruction and more inquiry and cooperative strategies tend to be employed with 1:1 technology	In properly implemented 1:1 technology initiatives technology is integrated into every intervention class (ELL, Title I, special education, etc.); online assessments are done at least	S Reviews (3) NS Reviews (1-2) Project RED (1) **Total = 5.5**
Funding	That multiple sources of funding will be required to sustain and upgrade 1:1 initiatives is weakly to moderately support.	The need for ongoing research and evaluation of 1:1 initiatives, including but not limited to cost-benefit analyses and return on investment (ROI) in relation to current practices and other educational innovations, is strongly advocated.	Regarding costs and saving, properly implemented 1:1 technology initiatives result in less paperwork, lower paper and copying expenses, higher teacher attendance, and improved student outcomes; estimate annual ROI is $459 per student or $25B nationally.	S Reviews (2-3) NS Reviews (2) Project RED (1) **Total = 5.5**

INTERVENTIONS

- Increase the computer: student ratio

Currently the students are deprived of optimal access to ICT facilities at FNU. As the premium national university in Fiji, and as one of the most important universities in the region, FNU must set examples in every aspect possible. Therefore, the computer to student ratio needs to be increased close to 1:1 in order to maintain this leading role of FNU.

- Increase connectivity

Providing computers will be of no benefit unless the bandwidth of Internet and access points for the intranet does not increase proportionately. By adding computers to the current bandwidth will only bring the existing productivity and efficiency down. Therefore concomitant increase of bandwidth is very important alongside increasing computers. FNU needs to consider installing connections which have larger capacity than it needs today or in a few years.

- ICT based teacher training

All the lecturers need to upgrade their teaching techniques and tools to match the new ICT based environment developing Hot skills needed in the 21st century. There is no benefit in providing such high grade ICT facilities if they are not used to their maximum potential.

- Online course support

Once the computer: student ratio reaches 1:1, all courses must have online delivery by way of an advanced virtual learning environment as well as class room based delivery. The student will have a unique ability of referring and learning the course in multiple environments as per the students' liking. This offers the learning flexibility in a liberal teaching environment.

- Online learning resources and library accessibility

Once the said optimal ratio is established, the library can go to the student. In the current situation, most of the libraries are available in online versions. Students at present often photocopy pages in books for their reference. By providing library services to their own access points will bring down this excessive photocopying of resources, with the added benefit or further reference based on the reading. This intervention will reduce the overcrowding in libraries, leading to reduction in energy consumption and many other issues alongside overcrowding.

- Peer education programme

Peers are the best source of motivating other students to follow a trend. Leadership role of some students can deliver rapid, stronger and sustained results than when the same is pushed by systems. Therefore it is

proposed to select peer leaders and train them to a higher level than others, where they will become the problem solvers and immediate points of support for the students. These peer leaders will be of great benefit to the college as they could maintain an interface between the college and the students.

COSTING

Taking into consideration the first two interventions of this project initially, student PC demand and bandwidth provision needs to be cost. There are some options available to meet the projected demand for additional 13,600 computers. These computers can be:

1. Desktops;
2. Laptops / Notebooks;
3. nComputing terminals;
4. Mix of the above.

In the case of Desktops and nComputing terminals, there is also the additional capital cost involved of building and furnishing computer labs. In all cases, capital costs relating to:

1. connectivity (accessing internet and intranet); and
2. power points are also involved.

In terms of initial capital cost, nComputing are generally assumed to be the most economical option for University funded computer additions. It is estimated that each nComputing terminal may cost no more than F$720 per terminal (F$2,200 for a desktop acting as a server with ten nComputing terminals @F$500 each connected to it i.e. F$2,200 + F$500x10 = F$7,200 / 10 = F$720). Desktops at around F$2,200 each are the most expensive option but can be FNU or student funded. Each such terminal will require at least 2.5 square meters of built-up space @F$1,500 per sq. m (including furniture and equipment) or F$3,750 per terminal.

Laptops have recently become more affordable and are probably the best and only practical equipment that can be student funded. While very low end notebooks are available for F$700, mid-range models are available for F$1,500. Another F$100 per unit is estimated as the initial cost of software and connectivity. Table 7 below summarizes the capital cost comparison of available options:

Table 7 – Per unit and total capital cost - FJD

Description	Desktop	nComputing	Laptop
Equipment	2,200	720	1,500
Building, furniture, air-conditioning, lights, and fans	3,750	3,750	-
Power Points	-	-	100
Connectivity and Software	100	100	100
Capital cost per unit	**6,050**	**4,570**	**1,700**
Total capital cost for 13,600 units	**82.3m**	**62.2m**	**-----**
Total capital cost for 15,700 laptop units*			**26.6m**

**Laptops to be provided to whole student population*

These additional equipment's will also have ongoing operating costs of:

1. electricity (consumed by equipment, air-conditioners, lights, and fans);
2. bandwidth (for internet access);
3. operating and other software (annual license fees);
4. post warranty support of the equipment;
5. salaries and wages (PC lab supervision, cleaning, security etc.); and
6. insurance.

Table 8 below compares their estimated annual operating costs:

Table 8 –Per unit and total operating costs for 2014 - *FJD*

Description	Desktop	nComputing	Laptop
Electricity (.08kWx12hrsx$0.5x365days)	175	175	175
Bandwidth	100	100	100
Software license	50	50	50
Post warranty support	50	50	50
Salaries and wages ($4/hrx24x365days for 40 units)	876	876	-
Insurance (@3% of capital cost)	182	137	51
Total per unit annual operating cost	**1,433**	**1,388**	**426**
Total operating cost for 12,500 units	**17.9m**	**17.4m**	**------**
Total operating cost for 15,700 laptop units*			**6.6m**

**Laptops to be provided to whole student population*

As tables 7 and 8 above bring out, laptops have the lowest capital as well as ongoing annual operating costs. Laptops also have several other advantages: ease of carrying them anywhere, better performance etc. These do have the disadvantage however of being more vulnerable to theft and damage, and three-year estimated useful life as against five years for Desktops and nComputing. It is useful therefore to compare their lifecycle costs.

Table 9 – Lifecycle cost comparison

Description	Desktop	nComputing	Laptop
Capital Cost, K	6,050	4,570	1,700
Annual Operating Cost, a	1,433	1,388	426
Estimated useful life in years, b	5	5	3
Total operating cost, a.b	7,165	6,940	1,278
Lifecycle cost, K+a.b	13,215	11,510	2,978
Cost of owning and operating each unit [K+a.b] / b	**2,643**	**2,302**	**993**

Overall, the cost factor and the versatility of laptops make the equipment more favored vis-a-vis other options.

Table10 – Annual cost for new additions - FJD

Description	Desktop	nComputing	Laptop
Equipment	2,200	720	1,500
Building, furniture, air-conditioning, lights, and fans	3,750	3,750	-
Power Points	-	-	100
Connectivity and Software	100	100	100
Capital cost per unit	**6,050**	**4,570**	**1,700**
Total PC additions - 4375 units (8% growth & 20% replacements)	**26.5m**	**20m**	**-----**
Total Laptop additions - 5000 units*			**8.5m**
Total annual operating cost	**1.9m**	**1.8m**	**2.1m**
Total annual cost	**28.4m**	**21.8m**	**10.6m**

**Estimated completely new registration per year - 5000*

Table 10 shows the cost associated with annual new additions to the pool of computers and it is evident that laptop is the most economical devise

POLICY RECOMMENDATION

FNU to provide 1 laptop per student at the point of enrolment

Justification of the recommendation

Much attention has been paid by lots of universities and schools around the world to roll out laptop programs and get faculty to adopt and adapt to such programs (e.g., Candiotti & Clarke, 1998; Hall & Elliot, 2003; McVay, Snyder, & Graetz, 2005; Platt & Bairnsfather, 2000; Schrum, Skeele, & Grant, 2002). Taking into consideration the cost factor over PCs and NComputing, Laptop is the cheaper solution compared to provision of Desktop and NComputing. Also, laptops nowadays have almost any conceivable connection and slot built in. USB, Firewire, Bluetooth, Wi-Fi, wireless, SD slots, mini-SD slots and what else not, everything is already in there. Many newer laptops have a camera and microphone already built in, for

Skype and video conferencing purposes. Mobility is the main benefit of laptop over PCs as students can use it just about anywhere internet access without being tied to a desk. The socio-cultural contexts of student's domestic computing play an important part in shaping students' interactions with computers. Students learn ICT at home and this makes students experts, changing their relations with teachers. Familiarity is a key aspect to developing habits of digital literacy. Some students are able to develop a wide range of digital literacy skills while others with restricted availability and lower levels of familiarity, reach only basic skill levels. The great advantage for developing such competencies is that laptops can be taken home even for home studies. This would help student to familiarize with the technology and information needed for their studies. Studies have shown that student satisfaction and motivation are really high when using laptops compared to the other solutions.

According to Technology Acceptance Model (TAM) suggests that perceived usefulness (U) and perceived ease of use (EOU) determine how well new technologies/tools are accepted by the end users. Perceived usefulness refers to degree to which the user feels the new system is going to contribute to enhance his/her performance and productivity. Perceived ease of use refers to the level of freedom from effort the user can achieve with new system intervention. TAM suggest that the Attitude towards using the system (A) is a direct result of the combined forces in U and EOU that intern affects Behavioral intention to use (BI). Actual use is determined by BI. Therefore the actual use and acceptance of ICT as a learning modality depends largely on how easy the system is to access and how beneficial it really is to the user. In the case of FNU, the student should be offered this ease through a personal, portable, convenient and capable device such as a laptop.

OWNERSHIP MODELS

In ownership, there are three models to choose from. They are as follows

1. University complete ownership
2. Student complete ownership
3. Joint ownership approaches

University complete ownership models

When the equipment is under the ownership of the University, the student only becomes a custodian of the equipment. There are more disadvantages than advantages in this model. The university is burdened with maintenance loss of equipment and damages. The capital tie up is also prohibitive in terms of net returns and also the burden of obsolete machines after the student completes the course.

Student complete ownership

Passing the ownership to student is the most suitable model in this kind of operation. The student pays for the machine in installments and acquires the machine. It will come at a much lesser price than from the open market as the university will buy in large bulk, and achieve remarkable economies of scale. The prices that the university can achieve could be directly passed down to the student and could maintain satisfaction at both ends. When the student actually owns it, there is better accountability and responsibility of the equipment. University will have no bet cash outflow in the venture other than to support its mandate of providing connectivity, support and training. Upon completion of the course the student is able to use the equipment for his/her personal matters or trade it in for an upgrade.

Joint ownership model

These models will also serve the purpose. University could subsidize the equipment and pass it on to the student at a lesser price than the purchase price. The student gets the full ownership after a stipulated period. The concerns of losses, damages or breakages will still burden the university. The accountability and responsibility on the part of student will not be as good as in student owned equipment. University will end up spending on capital as well.

Equity vs equality

In this type of venture the university should aspire to reach equity at the expense of equality. Equality is a situation that all students get identical equipment and facilities. Equity is a situation where the student receives equipment matched to his requirement. I.e. A student who studies for one year course will receive a netbook computer with one year warrantee whilst a student following a three year course will be offered a lap top with three year comprehensive warrantee and a student following a six months course will be provided with a tablet with 6 months warrantee. A medical student who studies a 5 year course will be offered a laptop with three year comprehensive and 2 year follow on service warrantees. Such measures

will not only match the need to the equipment but will also align the cost to requirement and return whilst serving for the best interest for the student and university both.

FUNDING MODELS

Student complete ownership model is the best solution. Even if students have the complete ownership, the university can consider some funding avenues. However, literature related to success stories indicates that effective 1:1 initiative use multiple funding models. Some possible funding models are;

1st Option: FNU to find startup costs funded by a capital campaign to raise dollars.

2nd Option: Students are to pay the university to purchase laptops at a low cost getting the economy-of-scale benefits of a bulk purchase and support package. A "phased lease" approach will be beneficial to help to create a defined timeframe for the laptops and permits more predictable annual budget planning.

3rd Option: To roll the cost of the laptop program into each student's tuition fees. This is possible through student fees as part of their learning experience – similar to module fee.

4th Option: The University can also consider advancing credit to students for purchasing laptops, the repayment burden can be mitigated by these students also choosing to forgo use of PC labs and earning tuition fee discount.

5th option: Reallocation from saved resources through replacement costs (e.g., reduction in textbook expenditures, professional development budget directed to 1:1 training, business processes) and combine funds from separate curriculum budgets or organisational units.

6th Option: Funds can be found from cost saving. Cost savaging can be implemented which include planning for wireless implementations rather than dedicated labs in new construction by reducing the need for a wide variety of lab equipment and network connections.

7th Option: FNU to find some grants from other organisations as community will have some business or philanthropic organisations nationally and internationally, e.g. Carnegie Mellon Foundation grants etc.

Due to the significant sums involved, all these funding options will have to be actively pursued to achieve the ambitious target of a computer per EFTS in 2014.

IMPLEMENTATION AND OPERATIONALISATION THE REQUIREMENT

- Each newly admitted student would receive information about the laptop requirement and the web link to the laptop purchase website; this would enable students to plan their laptop purchase to align with the school's laptop requirement.
- Students who purchase from the FNU's recommended list would then receive free hardware and software support, including free onsite warranty repair.
- FNU will keep a small number of laptop for check out by students as "loaners" should theirs needs to be serviced.
- Students would receive the Microsoft Office Suite as part of this initiative, as well as any educational and clinical software used college-wide to support education. Their laptop would be pre-loaded with these applications.

RESOLVABLE ISSUES

- The software loaded on the computers will fall under the university licenses reducing the software costs at the lowest level possible.
- Before purchasing additional software, FNU needs be clear on the learning objectives of the programmes in holistic way and how software will support these objectives. ICT can negotiate significant licensing agreements with major software companies, which may support the objectives without requiring additional expenditure. ICT needs to consider these agreements before purchasing more software.
- Warranty provisions need to be thoroughly communicated to students and parents so they recognize how the repair and replacement limitations relate to their personal responsibility over the laptops.
- The future obligations of being able to afford the long-term considerations such as software and hardware upgrades, maintenance, professional development, and technical support are ought to be taken into account. ICT division needs to consider a laptop program to plan carefully for the

challenges of keeping hundreds of laptops up and running while simultaneously maintaining the viability and security of the campus network.

- The most important is to teach teachers to enhance their existing curriculum by using the standard features of their computers creatively rather than relying on canned digital material because Laptops can be a sweet catalyst to get teachers to think about curriculum, and think differently leading to more dynamic, process-oriented teaching practices.
- It is needed to be considered that students bring electronic devices to campus at their own risk. FNU will not be responsible if an electronic device is lost, stolen or misplaced. Purchasing insurance for the device is recommended.
- Software programs are complex, and because there are useful new software features and applications available every year, there is always more for students to learn about using computers well.
- It needs to establish a review group to oversee progress and resolve problems and we need to accept there are risks as well as learning experiences and a need for adjustments.

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