

# GENERIC SKILLS DEVELOPMENT: INTEGRATING ICT IN PROFESSIONAL PREPARATION

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## **Abstract**

*Tertiary education research, policy and practice increasingly are focused on the generic skills, including information and technology literacies, developed over the course of the students' academic career to graduation. Concurrently, professional and educational literature related to the use of information and communication technologies (ICT) expounds its benefits in supporting and enabling health professionals undertake their roles and responsibilities. This paper describes an investigation of the impact of formal and informal resources and curriculum-integrated skill development activities available to first-year undergraduate students in contributing to the development of multiple literacies.*

## **Keywords**

*ICT literacy, information literacy, generic skills development, professional preparation*

## **Background**

Tertiary education research, policy and practice increasingly are focused on the generic skills to be developed over the course of the students' academic career to graduation. It has been identified that universities must support students through multiple literacy development, including information literacy and computer/technology literacy (Patrikas & Newton, 1999; Oliver & Towers, 2000a).

Concurrently, professional and educational literature related to the use of information and communication technologies (ICT) expounds its benefits related to the roles and responsibilities of the health professional. Current and emerging technologies can make assessment and management of health-related practices more efficient and effective. Networked systems allow for more current and equitable dissemination of and access to information. Importantly, they provide the potential for effective communication among health professionals and between public/patient and health professional. Today, and increasingly in the future, the client/student has as much or more access to health information resources as the health professional. Hence, ICT literacy is a critical skill for health professionals to undertake their roles and responsibilities (Milio, 1996; Committee on Enhancing the Internet for Health Applications, 2000).

While perceptions and use of ICT in some specialised health service delivery areas have kept pace with other industries, the case is not mirrored for the areas of community and school-based health. One indication of this is the slow take up of integration of ICT into the pedagogical strategies and delivery mechanisms within related University-based programs. While some teaching and learning innovations have been successful (Jayasuriya, 2000; Lockyer, Patterson & Harper, 2001; Lockyer, Patterson, Rowland, & Hearne, 2002; Rowland, Lockyer & Patterson, 2001; Yeatman, 1997; Yeatman, 2000), widespread dissemination throughout health professional preparation programs has yet to occur. A second indication is the low level of ICT literacy of commencing graduate-level health students, who are currently employed within general health services and in community organisations. Many health

professionals started their careers 10-20 years ago and have not been trained in ICT areas. This is exacerbated when they attempt to further their careers by returning to study but experience difficulties in utilising ICT within their academic programs and in relating its relevance to their professional roles. Further, recent school leavers entering undergraduate health professional preparation programs such as physical and health education, nursing and exercise science most often have not experienced curriculum-based use of ICT in their secondary school health education programs.

The aim of the project reported here was to promote and facilitate the perceptions and use of information and communications technologies (ICT) within professional practice context through the development and evaluation of a module on information literacy and ICT skills for first year students. The project placed particular emphasis on those involved in aspects of health education, promotion, care and service delivery.

### **Context of this study**

To support the development of the identified range of attributes of a University of Wollongong graduate (University of Wollongong, 2001), this regional tertiary institution has implemented a number of formal and informal support resources. Such resources include:

- The *Information Literacies Introductory Program (ILIP100)* is a compulsory, zero credit point subject which must be completed within the first six weeks of session one. The program supports first year students' ability to locate, use and evaluate information effectively. Through online tutorials or a library-based workshop, students learn how to conduct a search in the library catalogue, locate items in the library collection, identify journal-based literature and understand and access items associated with course-related reading lists (available at <http://www.library.uow.edu.au/helptraining/workshops/ilip/index.html>).
- A range of online tutorials are accessible from the library website and library-based tutorials available free of charge cover skills such as finding journal articles and searching and citing the Internet.
- The *Undergraduate Information Skills Handbook*, produced by the library and available at cost from the university bookshop, focuses on developing skills to access information and information technologies available in the academic environment
- *Operation Rover* is a program of helpers circulating in the general access student computing laboratories to help support students struggling with computer application difficulties (e.g., accessing e-mail, word-processing, using subject websites, etc.)
- Seminars and workshops that cover introductions to the university computer facilities, course management system (WebCT), Internet and e-mail, Windows, word-processing and printing are available during orientation week and for the first four weeks of session.

While much effort contributes to the development and delivery of such resources, there exists only anecdotal evidence of their effectiveness. Further, it is not known whether students are able to apply such generic skill development activities back to their course assessment work or to their professional career development. These questions, coupled with arguments for integration within discipline-based explorations and authentic tasks (Herrington & Oliver, 2000), led to an investigation of the information literacy and technology literacy skills of first-year undergraduate students enrolled in professional preparation courses. The project focused on student access to the skill development resources made available by the university and their peers and who also engage in curriculum integrated tasks.

### **Study design**

A case-control design was implemented. This design allowed the researchers to determine the effect of the informal and formal ICT-related and information literacy skill development support provided by the university while at the same time determining the impact of the curriculum-integrated intervention.

A survey instrument (based on Meredyth, Russell, Blackwood, Thomas & Wise, 1999; Oliver & Towers, 2000b) was developed to gather data from both case and control groups related to demographics; confidence and competence in using computers; Internet usage in terms of location, frequency and purpose; computer and Internet applications currently used; computer/Internet applications students anticipate they will use to support their university studies; computer/Internet applications students

anticipate will be useful to them in their professional practice; and web-related information literacy skills and knowledge (i.e., criteria considered by students for evaluating web-based resources and information necessary to cite web-based resources).

Two first-year undergraduate subjects were selected to participate in the intervention. Both subjects support programs for the preparation of health professionals. *BMS103 – Human Growth, Nutrition and Exercise* is part of the Faculty of Health and Behavioural Science's exercise science and nutrition undergraduate programs. Graduates from such programs go on to practice as exercise therapists, fitness centre administrators and dietitians. *EDUP153 - Foundations of Personal Development, Health and Physical Education* is part of the Faculty of Education's Bachelor of Education in Physical and Health Education undergraduate pre-service teaching degree. Graduates of this program go to such roles as physical and health education secondary school teachers, curriculum developers, physical fitness personal trainers, fitness centre administrators and community health professionals.

The intervention involved a set of tutorial tasks. The introduction to the tasks was provided on the subjects' websites which also facilitated students' pre-task exploration of the University of Wollongong Library's online tutorial *Evaluating Web pages & Citing Internet Resources* (available at [www-library.uow.edu.au/help/training/workshops/evalnet/index.html](http://www-library.uow.edu.au/help/training/workshops/evalnet/index.html)). Two online tasks were included on the subjects websites' quiz mechanisms:

1. Students were asked to conduct a Web search on a topic related to one of the subject assessment tasks using a selected search engine – Google ([www.google.com](http://www.google.com)). Students were to identify the search terms used and provide citations, using the Harvard system, for five of the relevant websites found by their search.
2. Students were then provided with two randomly assigned websites relevant to the subjects. Students were asked to evaluate and provide their assessment of the sites with respect to authority, purpose, currency and other criteria on a scale of 1 to 5 (a score of 1 meaning poor and a score of 5 meaning good). The sites provided were pre-assessed by the researchers and their responses correlated. Students' ratings were assessed against researchers' ratings and a score given as to concordance or degree of discordance.

The intervention for the Education group was a component of an assessable task that also included the development of a written report.

Pre- and post-intervention surveys (as previously described) were administered to the students in week 1 and 12 of session. Students in each class were also invited to volunteer for a group discussion which focused on issues of the content, conduct and perceived relevance of the tutorials.

Two complementary first-year, undergraduate subjects within the same faculties were selected to act as control groups (i.e., those students who have access to the range of ICT-related and information literacy skill development support provided by the university). *PSYC121 – Foundations of Psychology* is offered by the Faculty of Health and Behaviour Science within the Bachelor of Psychology program. In Education, *EDUT111 - Curriculum and Pedagogy I* (a core subject in the professional preparation program for primary school teachers) was selected to act as the control group. Students in those selected classes were approached during their lectures in week 1 and then in week 13 of session for the administration of the pre and post surveys.

## Results

### Description of study participants at entry into the study

The participants in the study were all students enrolled in the four first year classes at the University of Wollongong, two classes in the Faculty of Health and Behavioural Sciences and two classes in the Faculty of Education. A total of 535 participants commenced the study, of which 73 percent were women and 27 percent were men. The largest age group was 17/18 years (51%), the mean age of the group was 21 years, with a range from 17 to 52 years. A majority of participants (61%) were recent school leavers.

Students' reported knowledge of computers was fairly evenly split between low/very low (54.0%) and high/very high knowledge (46.0%), with few students reporting either very high (6%) or very low (2%) knowledge. As students' age increased, so did their reported knowledge of computers ( $P = 0.0065$ ).

Three quarters of students (77%) reported feeling confident or comfortable using computers. Age, gender and year commenced university study were significantly associated with feelings of confidence in using computers. Both males and females rated confidence/comfort with computers highly (78% and 76% respectively) but males were more likely to express confidence than females (33% vs 18%,  $p = 0.0016$ ). The pattern for age association with feelings of confidence/comfort with using computers was complex. The second oldest group (23/24 years) expressed most confidence with using computers (33% - confident, cf 23-24% for other age groups); the youngest age group (17/18 years) reporting most comfort with using computers (57% cf 42-51% for other age groups) and these two groups rated their combined confidence/comfort most highly (80% - 17/18 years; 84% - 23/24 years). The association of age with feelings of confidence/comfort was significant,  $P = 0.029$ .

The two most common uses of computers was for word processing (64% students reported weekly use) and desktop publishing (17% reported weekly use).

Over half of students (62%) used the Internet at least several times per week, if not daily, and another 20% of students used the Internet weekly. Students who had already commenced tertiary study were more frequent users of the Internet than recent school leavers ( $P = 0.0011$ ). The major use of the Internet was to send/receive emails (61% several times per week/daily); followed by web searching/browsing (36-40%) and use of chat spaces was low (15%). When asked how they thought they would use computers to assist in their university studies, the responses reflected the students current usage – 93% reported they would use word processing at least weekly; 87-89% would use computers to search the web or access web addresses; and 80% reported they would use it to send/receive emails.

Students were asked how they thought they would use computers for professional purposes. Their responses again reflected their current usage of computers – 89% would use word processing at least weekly for professional purposes; 84% would use email and browse the web; 62% also identified use of spreadsheets (cf 41% for academic study); 56% use of databases (cf 34% for academic study); 54% for presentation (cf 44% for academic study); 47% for desktop publishing (cf 39% for academic study). Overall, 60% of students thought computers would be very useful and 36.5% thought computers would be useful for their professional roles.

The main criteria used by students to judge the quality of websites were, in descending order, quality of information (89%); up-to-date information (84%); layout and ease of use (80%); depth of information (62%); quick loading (51%); credibility (51%); graphics (27%) and interactivity (20%). The use of four of these criteria varied significantly with age – quality of information, up-to-date information, layout and ease of use and graphics – with younger students ranking these criteria more highly.

Students knew to include the URL (75%), author's name (68%) and title of work (65%) in the citation of an electronic publication but were less familiar with the requirements for date of publication (54%) and date accessed (29%). This probably reflects an approach to citation based on print materials, not electronic. Knowledge of citation requirements varied with age, with the oldest group more likely to cite place of publication as necessary ( $P = 0.05$ ) and the youngest age groups were most likely to cite URL as necessary ( $P = 0.0005$ ).

Students were not randomly allocated to the intervention groups, selection was based on enrolment in a particular subject. Differences between cases and controls were investigated to ensure that the two groups were similar. The ratios of cases and controls in the two faculties and in total were approximately 50:50 (Health – 42%:58%; Education – 54%:46%). No difference was found with regard to balance of sex in the two groups but a significant difference between the ages of cases and controls was found for both faculties (Health,  $P=0.0024$ ; Education,  $P=0.0018$ ; total,  $P<0.0001$ ). No difference was found between the cases and controls in the two faculties for the year they commenced tertiary study, nor was a difference found in Education regarding previous tertiary study of cases and controls (for Health, a difference in previous tertiary study may have been present,  $P=0.05$ ).

### Student performance on Internet tasks

The number of students who completed the first component of the task, correct referencing of five Internet sites using 5 criteria (author, date published, title, URL, date accessed) and correct format was 139 of 165 Health students (84%) and 67 of 79 Education students (85%). Of a possible mark of 30, Health students scored an average of 16.4 (29 students scored zero; mean of 1-30 = 23.7) and Education students an average of 28.8 (no students scored zero). The medians were 25 and 27 respectively.

The number of students who completed the second component of the task, evaluation of websites, varied between the two faculties. In Education the majority (74 of 79, 94%) of the students completed this section while in Health less than half (71 of 165, 43%) of the students completed this section. Differences existed in the conduct of the tasks in the two faculties. All students received the same instructions and were assisted in the tutorial task by an experienced tutor. In the Education faculty the task was conducted in a fully functional computer laboratory, all students had access to a computer and the activity was a component of an assessment task. In the Health faculty, the available computing facilities were not fully functional, not all students had access to a computer during the conduct of the tutorial sessions and the task was not a compulsory component of the subject.

Overall, all students performed poorly on the evaluation of websites task. The number of 'correct' evaluations (score = 0, no difference to the independent rating) was very low (4% of Health and 2% of Education evaluations). The average mark achieved by the students was approximately 50% (Health, average mark = 48%; Education, average mark = 50%). The evaluation criteria ranked most consistently with the appropriate ranking was Purpose of the site, followed by Authority and Currency. Refer to Table 1.

Faculty	Website Evaluations – total scores (range: 0 > -8)			
	Site 1 ave. mark (0>-8)	Site 2 ave. mark (0>-8)	Average of both marks	No. 'correct' (mark = 0)
Health (N=71, 43% cases)	-4.02	-3.89	-3.85 (48%) (N=56, as 15 evaluated only 1 site)	5 (4%) (out of 127 evaluations)
Education (N=74, 94% cases)	-4.16	-3.87	-4.03 (50%) (N=71, as 3 evaluated only 1 site)	3 (2%) (out of 145 evaluations)
Faculty	Website Evaluations – scores for criteria (possible: 0, -1, -2)			
	Authority	Purpose	Currency	Other
Health	-0.98	-0.71	-1.15	-1.03
Education	-1.15	-0.65	-1	-1.19

Table 1. Tutorial task 2 – website evaluations

### Changes achieved through the intervention

All students in Health and in Education reported significant increases in frequency of use of the Internet.

Perceived use of the Internet for professional purposes changed for the cases in Health. Students had become more circumspect regarding the use of the Internet. It was still considered useful for professional purposes (rating of 'useful' increased from 35 to 60%) but fewer students rated it as 'very useful' (rating decreased from 60% to 43%). This contrasted with the Education students, whose rating remained at 'very useful' for both cases (99%) and controls (who did increase from 93 to 100%).

Criteria for judging Internet sites were specifically addressed in the intervention. The control group in Education was the only group not to change their reported use of criteria to judge Internet sites. Reporting of 'Credibility' increased as a criterion for judging Internet sites for cases in Health (P=0.03)

and Education ( $P < 0.0001$ ) and controls in Health ( $P = 0.0002$ ). 'Quality of information' was reported more frequently by cases in Education ( $P = 0.017$ ) and controls in Health ( $P = 0.0048$ ). Cases in Health reported 'Up-to-date information' more frequently ( $P = 0.004$ ), while Controls in Health reported lower use of 'Graphics' ( $P = 0.030$ ) and 'Interactivity' ( $P = 0.017$ ) as criteria for rating Internet sites.

Appropriate referencing of electronic resources was addressed in the intervention. Cases in both faculties demonstrated significant improvement in almost all elements of referencing, including significant decrease in unnecessary elements (for example language and country of publication). Controls in Health demonstrated improvement in some elements, increasing reporting of author's name, date accessed and URL and decreased reporting of page numbers. Controls in Education only increased their reporting of the need to cite the URL of the electronic publication. Refer to Table 2.

	Health		Education		Total	
	Cases	Controls	Cases	Controls	Cases	Controls
Author's name	62 -> 88%, $P = 0.0001$	67 -> 86%, $P = 0.0016$	66 -> 98%, $P < 0.0001$	nsd	64 -> 90%, $P < 0.0001$	70 -> 83%, $P < 0.0049$
Title of work	61 -> 83%, $P = 0.0003$	nsd	59 -> 96%, $P < 0.0001$	nsd	60 -> 88%, $P < 0.0001$	nsd
Publisher/ organisation	nsd	nsd	48 -> 71%, $P = 0.0091$	nsd	55 -> 69%, $P = 0.0068$	nsd
Date of publication	59 -> 73%, $P = 0.0321$	nsd	49 -> 85%, $P < 0.0001$	nsd	56 -> 77%, $P < 0.0001$	nsd
Date accessed	25 -> 74%, $P < 0.0001$	32 -> 71%, $P < 0.0001$	22 -> 94%, $P < 0.0001$	nsd	24 -> 80%, $P < 0.0001$	33 -> 58%, $P < 0.0001$
URL	62 -> 92%, $P = 0.0024$	74 -> 99%, $P < 0.0001$	70 -> 100%, $P < 0.0001$	80 -> 95%, $P < 0.0485$	74 -> 95%, $P < 0.0001$	76 -> 97%, $P < 0.0001$
Language	nsd	nsd	11 -> 00%, $P = 0.0117$	nsd	16 -> 07%, $P = 0.0064$	nsd
Country	27 -> 14%, $P = 0.0269$	nsd	nsd	nsd	23 -> 12%, $P = 0.0059$	nsd
Page numbers	nsd	26 -> 45%, $P = 0.0014$	nsd	nsd	nsd	26 -> 39%, $P = 0.0119$

Table 2. Identification of information required to reference an Internet resource.

### Comparisons of student populations, pre and post surveys

The post survey was conducted in the final week of the semester and numbers were reduced (Health, 57% reduction, down to 168; Education, 16% reduction, down to 122). The post survey was undertaken in a lecture time in Health and in a tutorial time in Education. Demographic and other comparisons were made between the pre and post student groups, for both cases and controls. The Education Case and Control groups were not significantly different before and after the intervention on any descriptor. The Health Case group did not change in characteristics pre and post survey. The Health Control group were the same pre and post except for year of enrolment at university, with more enrolled in 2001 and 1998 and less enrolled in 2000 ( $P = 0.0058$ ).

### Focus group feedback

Focus group discussions were conducted in both faculties (Health, number of participants = 9; Education, number of participants = 13). This provided feedback on the content, the conduct and the perceived relevance of the tutorials. Students in both faculties reported that the content of the tutorials was appropriate and easy to use and that the tutor had been helpful, especially for those students initially lacking confidence in the use of computers or in searching the Internet. Generally the value of the tutorials was considered positive, as although most students had used the Internet before, mainly for school or for general use, they reported that they had not developed any systematic search strategies or critical thinking skills about using the Internet. They also had lacked basic knowledge of appropriate referencing of Internet resources. Linking the in-class tutorial with the available electronic library tutorial

on searching and appraising the Internet was considered very beneficial, as several students reported referring to the library tutorial site on subsequent occasions for other assignment tasks.

Several differences between the Health and Education groups were identified. Firstly, the Health students reported low completion rates for the tutorial tasks while the Education students had high completion rates. Health students identified lack of completion was due to structural barriers such as poor computing facilities and overcrowding in computer rooms, together with the non-compulsory nature of the tasks. No student had completed the task in the tutorial time allocated and had to either go to other computers on campus or use their computers at home to submit their final work. The tutorial was compulsory for Education students as they received a mark for it and it was also linked to a subsequent assessment task. However, this linkage of the tutorial to another task was reported to have caused some confusion and students recommended that the two activities should be more directly linked.

## Discussion

This study contributes to the developing understanding of the entrance stage skills of undergraduate students and the interventions that might be put in place to support the development of those skills through their academic career toward commencement of professional practice. Certainly, to be an effective professional in an increasingly technological environment and to address the needs and expectations of employers (Davis, 1997; Ramsay, 2000), generic skills associated with undergraduate students' information and ICT literacies must be enhanced.

As evidenced in the change in knowledge of Internet source citation requirements by control group subjects, formal and informal resources and support structures such as library workshops, guides and online tutorials do go some way to facilitate skill development. However, the significant increase in understanding of evaluating and citing Internet sources by participants in the intervention groups provides evidence for the importance of integrating ICT training into curriculum for true effectiveness. A solid curriculum-based skill development activity can benefit from online tutorials and guides that can be referred to at subsequent stages.

The relationship between both completion and effectiveness of the learning experience as an assessable task for the Education case group demonstrates a need to give academic recognition to the development of ICT skills. Further, the scope of the task (i.e., one tutorial activity within a 13-week session) highlights the fact that is relatively easy to make significant improvements in basic ICT skills. It is encouraging to consider that implementation of such a skill development activity early in the first-year undergraduate program (e.g., week four of the first undergraduate session) can provide students with a significant grounding for subsequent subjects and learning activities that lecturers may design based on assumptions about and aimed to build upon previously developed skills.

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