

## EXPLORING INFORMATION LITERACY DEVELOPMENT IN MEDICAL RADIATIONS STUDENTS

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### ABSTRACT

Advanced information literacy (IL) is paramount in pathway building to independent lifelong learning. An evaluation tool created to explore IL development in a group of Medical Radiations students demonstrated strengths and weaknesses in IL. This provides evidence for lifelong-learning, graduate-capability development, and can enable teaching teams to design supportive learning activities.

### INTRODUCTION

Around the world in the past three decades we have produced more new knowledge than in the previous five millennia (Nelson, as cited in Andretta, 2001), and it is estimated that 90% of the information we might need is not where we are (Gibbons, 1998). Fortunately, also at this time, there has been a revolution in information and communications technology (ICT) which has at least provided us with the potential for increased accessibility to this deluge of information. With the rapid and continuous growth in scientific knowledge and technological advancement, the need for this accessibility increase is vital. For the health disciplines this has meant that medical knowledge now doubles every three years, and the shelf-life of knowledge for a variety of healthcare practitioners is between three and five years (Sim, Zadnik, and Radloff, 2003). The necessity for healthcare professionals, including Medical Radiations practitioners, to develop as independent and lifelong learners is clear.

#### Information literacy

Lupton (2004) suggests that information literacy be considered as a subset of independent learning, which in turn can be considered as a subset of lifelong learning, as shown in Figure 1.

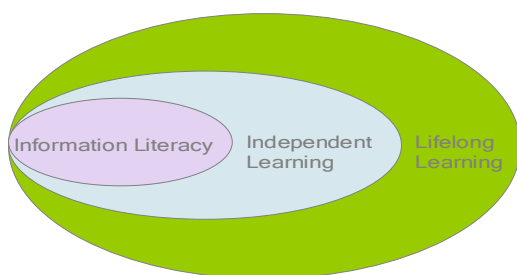


Figure 1. Relationship of information literacy to lifelong learning.

*Note.* From 'Overview' by M. Lupton, 2004. In Australian and New Zealand Information Literacy Framework, principles, standards and practice (2<sup>nd</sup> ed.) (p. 5).

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Appreciation of this subset association is also recognised by many Australian universities who have lifelong learning as a requisite graduate capability, with information literacy as a dimension of that capability. (Bundy, 2004, Johnston and Webber, 2003). To ensure both teaching quality and capability development, evidence of this development should be gathered by academic staff.

Information literacy (IL) is defined in most Australian universities through reference to the *Australian and New Zealand Information Literacy Framework* (Bundy, 2004).

Six core standards describe the abilities of the information literate person as one who

- recognises the need for information,
- finds needed information effectively and efficiently,
- critically evaluates information and the information seeking process,
- manages their collected information,
- constructs new understandings and communicates information,
- uses information ethically and legally.

(Adapted from Bundy, 2004, p.11)

### The project

In 2005, a research project was conducted to explore information literacy development in a group of Medical Radiations students at RMIT University, with the aims of exploring their IL skills, habits, and confidence in their IL

abilities. Their development would then be compared with the IL standards, (Bundy, 2004), and their strengths and weaknesses identified. This information could then be used to inform teaching quality and the further development of learning and assessment activities appropriate for the support of information literacy. An awareness of the students' views regarding the importance of lifelong learning was also sought.

Whilst the students were actively participating in learning and assessment activities which aimed to strengthen their IL skills, evaluating the impact of these activities was not the primary aim of the project. Rather, it was to identify the level of IL skills students might have at the beginning and end of a single semester, to ask them to reveal their habits associated with IL, and to evaluate the confidence they have in their overall IL abilities. There was no research identified that combined student self-assessments in this way.

The project was approved by the RMIT University Human Research Ethics Committee, and was supported by an RMIT University Action Research grant.

## METHOD

### IL evaluation tool

An evaluation tool, in the form of a questionnaire, was developed. The current literature was consulted (Catts, 2003; Australian National University Library, 2005; V. Perret [personal communication, April 26, 2005] of the full copy of online questionnaire of the Graduate Information Literacy Program Skills Audit; Sim, 2000), and some questions which had previously undergone reliability testing were included (Australian National University Library, 2005). Other questions were adapted to be more appropriate for RMIT University library systems and the Medical Radiations students' needs and knowledge bases, while more were developed by the research team and piloted amongst a group of academic peers and post-graduate students to assist with construct validity. The evaluation tool consisted of questions which addressed all six IL standards as follows:

- Section A. Demographic information relating to age group, English as a second language and tertiary academic history.
- Section B. IL Skills: 10 multiple choice questions, scored out of a maximum of 10.

- Section C. Self scoring of IL Habits, including a scaled response and comments.
- Section D. Self scoring of Confidence in IL Abilities level, by rating their abilities to effectively access, manage, and use information – using both a scaled response and comments.

The questionnaire was used at both the beginning (week 3) and the end (week 12), of semester 2, 2005. In the second use of the tool, a final reflection was requested asking the students to consider why advanced IL skills might be important for their academic and professional development. In this manner, an orientation to, and knowledge of, lifelong learning was also being elucidated. The evaluation tool is available from the authors.

### Data analysis methods

Quantitative evaluation was conducted using Statistics Package for the Social Sciences (SPSS) V13, using paired sample *t* tests and Pearson correlation (two-tailed) analysis. Descriptive rankings were assigned weighted scores in order to develop mean composite scores for the IL Habits, and Confidence in IL Abilities sections. The IL Skills section consisted of 10 multiple-choice questions with only one correct answer; correct answers were assigned a value of one with any incorrect answer assigned zero, leading to a possible total score of 10.

Qualitative evaluation was conducted using two pairs of reviewers who independently identified themes and allocated student responses according to those themes.

### Participants

The paired questionnaires were completed by 28 students; 24 of 34 students from a second-year group of the Bachelor of Applied Science in Medical Radiations, and 4 of 5 students from the first year of the Master of Applied Science in Medical Radiations program. Table 1 shows key demographic features of the group.

## RESULTS

### IL skills

The students demonstrated a range of IL skills relative to all six IL standards. The IL Skills from each questionnaire were scored out of 10, with the mean values calculated and compared. There was a statistically significant increase in IL skills between uses of the questionnaire, at the  $p < 0.05$  level. Figure 2 indicates the IL Skills scores out of 10 (Y axis) of each coded student (X axis) for the first and the second use of the questionnaire. A mean value of 7.18 ( $SD = 1.65$ ) was calculated for the first use, and a mean value of 8.30 ( $SD = 1.02$ ) was calculated for the second use. There were 20 of 28 students, (71%), who demonstrated an improvement in their IL score; 4 of 28 who stayed the same, (14%); and 4 of 28, (14%), who demonstrated a decrease in their IL Skills score.

Demographic	<i>n</i> = (Total <i>n</i> = 28)	% of total (Rounded to nearest %)
Gender: Males	9	32
: Females	19	68
Age Range: 1 (17-24)	23	82
: 2 (25-34)	4	14
: 3 (35 and over)	1	4
English as Second Language: Yes	6	21
: No	22	79
Tertiary Academic History: None	18	50
: TAFE award	1	4
: Undergraduate	7	25
: Postgraduate	2	7

Table 1. Demographic Information on Student Cohort.

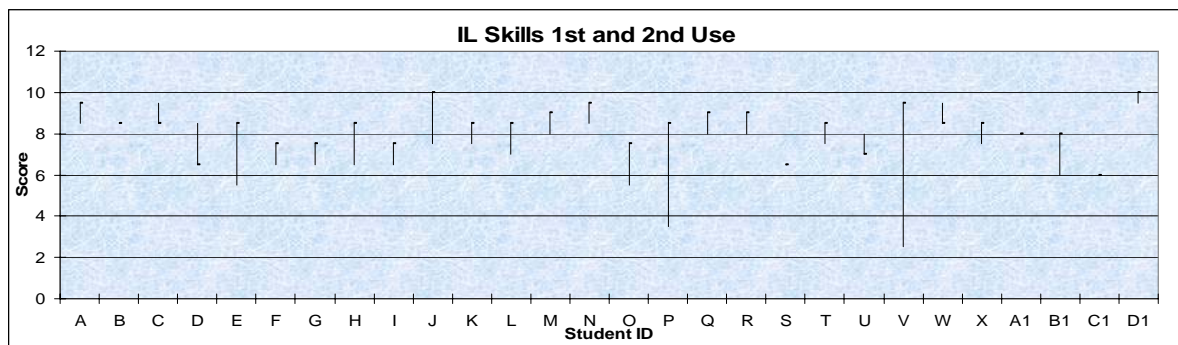


Figure 2. IL Skills Scores from first and second use (dot), of the questionnaire.

### IL habits

Students' self-reported IL Habits (ranging from *Always* to *Never*) were assigned scores for quantitative analysis, ranging from 0 to 4. This was repeated for both uses of the questionnaire, with a comparison of means made – as shown in Figure 2. There were statistically significant improvements at the  $p < 0.05$  level reported by the students in IL Habits relating to five of the

six IL standards. However, the question relating to asking the librarian to help locate the best sources of information, (Question 16, Standard 2), revealed a low response: 0.75 and 0.96 for the start and end of the semester respectively. There was no statistically significant difference between the two mean values.

Question (IL Standard)	Mean 1 <sup>st</sup> use (SD)	Mean 2 <sup>nd</sup> use (SD)	p value ( $p < 0.05$ )
Q15. When I have an assignment / project to do, I use a variety of information sources (1)	3.00 (0.720)	3.39 (0.629)	0.013
Q16. When I need to find information, I ask the librarian to help identify the best information (2)	0.75 (0.701)	0.96 (0.922)	0.161*
Q17. I revise my search plan or strategy if I need to find more information (3)	2.89 (1.100)	3.36 (0.780)	0.013
Q18. I use a system for organizing and storing the information I find so I can use it later (4)	2.57 (1.317)	3.04 (0.922)	0.045
Q19. I use a range of programs and software to present my assignments projects (5)	1.96 (0.999)	2.64 (1.026)	0.000
Q20. I apply the laws of copyright when I am researching and writing my assignments (6)	3.04 (1.170)	3.46 (0.999)	0.020

Table 2. Analysis of Mean scores for self-reported IL Habits. (Values of  $p \geq 0.05$  indicate the difference in Means is not statistically different from 0.)

\* Not significant.

### Confidence in IL abilities

Qualitative evaluation revealed sound IL Habits in most areas (“I use a variety of information sources” and “...software” and “I use a system for organizing and storing information”), with the under-utilisation of the librarian as someone to help identify best sources of information. While comments revealed that students were aware that they should comply with copyright laws and not plagiarise, many were not confident that they were successfully doing this. Students reported that they revised their search strategies only if more, or more relevant, information was required. Refer to Table 2 for the questions.

Considering both the self-selected ratings and the comments from the students, there was substantial confidence demonstrated in their abilities to effectively access, manage, and use the information they need and find for their studies. Student ratings of their abilities (ranging from *Poor* to *Very Good*), were assigned scores for quantitative analysis (ranging from 0 to 4). This was repeated for both first and second use of the questionnaire, with a comparison of means calculated as shown in Table 3. There were statistically significant differences between the mean scores for accessing, managing, and using information, across the first and second uses of the questionnaire.

Question: Rate your ability to effectively (Standards)	Mean 1 <sup>st</sup> Use (SD)	Mean 2 <sup>nd</sup> Use (SD)	p value ( $p < 0.05$ )
access information you need. (1&2)	2.46 (0.744)	2.75 (0.844)	0.030
manage the information you find. (3&4)	2.43 (0.920)	2.86 (0.891)	0.008
use the information you find. (5&6)	2.50 (0.793)	2.93 (0.813)	0.001

Table 3. Analysis of mean scores for self-rated IL Abilities. (Values of  $p \geq 0.05$  indicate the difference in Means is not statistically different from 0.)

### Reflection on IL skills for lifelong learning

When asked to reflect on the importance of advanced IL skills for their academic progress, students identified the following reasons: efficiency and effectiveness of searching, making the best use of their time, increased marks, and an increase in quality and relevance of their work. When asked to reflect on the

importance of advanced IL skills for their professional futures, students' responses ranged widely, from demonstrating no understanding of continuing professional development, to demonstrating a clear understanding of this. Respondents also identified additional reasons for the need for advanced IL skills, namely,

implications for evidence-based personal practice, professional and academic development, and efficient and effective searches.

### Correlation analysis

Composite mean scores were derived from the weighted scores assigned to each of the student ratings relating to IL Habits, and Confidence in IL Abilities. Scores from IL Skills were calculated as a mean value between the two uses of the questionnaire. Pearson Correlation analysis was then performed to look for correlations between,

- IL Skills, and IL Habits;
- IL Skills, and Confidence in IL Abilities;
- IL Habits, and Confidence in IL Abilities.

There were no correlations found between the mean score for IL Skills and the composite mean for IL Habits, nor any correlation between the mean score for IL Skills and the composite mean for Confidence in IL Abilities. There was, however, a positive correlation identified between the composite mean scores for IL Habits, and Confidence in IL Abilities, as shown in Table 4.

Correlation between:	Pearson Correlation	Significance to $p < 0.01$ (2-tailed)
IL Skills and IL Habits	-0.051	0.797
IL Skills and Confidence in IL Abilities	0.135	0.493
IL Habits and Confidence in IL Abilities	0.610	0.001

Table 4. Correlation analysis between composite mean scores for IL Skills, IL Habits, and Confidence in IL Abilities. (Values of  $p > 0.05$  indicate the correlation is not statistically different from 0.)

The correlations between student's age and academic history on the one hand, and their IL Skills, IL Habits, and Confidence in IL Abilities, showed three positive and significant correlations. These were between the

- reported IL Habits, and the Academic History of the student;

- Confidence in IL Abilities, and the Academic History of the student;
- Confidence in IL Abilities, and the Age of the student.

There was also a positive correlation between two of the demographic factors, Age and Academic History, but not with any other demographic factors; as shown in Table 5

. Correlation between:	Pearson Correlation	Significance to $p < 0.01$ (2 tailed)
IL Habits and Academic history	0.391	0.04*
IL Abilities and Academic history	0.822	0.00
IL Abilities and Age	0.623	0.00
Age and Academic History	0.656	0.00

Table 5. Correlation analysis between demographic factors. (Values of  $p > 0.05$  indicate the correlation is not statistically different from 0.)

\* Significance at the 0.05 level (2-tailed)

### DISCUSSION

All students were participating in learning and assessment tasks specifically designed to support the development of IL through independent searching, evaluation, and presentation of current professional information. This research has shown statistically significant improvements in student IL Skills, Habits, and Confidence in IL Abilities across a semester. The statistically significant increase in mean

scores in IL Skills is in accord with other researchers (Kaplan, Jacobs, Rosenfeld, and Haber, 2003; Verhey, 1999; Hall, Nunan, Foxlee, and Kruesi, 2005) who report that curriculum integrated approaches result in an increase in IL skills in undergraduate students.

The self-rated Confidence in IL Abilities of the students related to their accessing, managing, and using information across the semester. The increase in self-confidence after undertaking purposefully designed IL learning activities is in

agreement with Monoi, O'Hanlon, and Diaz (2004), who reported that students who have positive learning experiences with online searching are more likely to have a higher level of confidence in their IL abilities.

The IL Habits assessments were based on student self-assessment. There was no validation of these assessments by the researchers and, as such, the students could fabricate them. What is apparent, is that even if there are no actual improvements in the IL Habits of the students, there is an increasing awareness that these are important and desirable habits. The only IL Habit where there was not a statistically significant change was the utilisation of the library staff to identify the best sources of information. The librarians provide tutorials on research skills, and they expect tertiary students to become independent learners. It should not be assumed that the lack of utilisation of a librarian indicates well-developed, independent learning skills. This question could be better phrased to elucidate the issue.

It is interesting to note that the only statistically significant correlation identified when examining the relationships between IL Skills, Habits, and Confidence in IL Abilities was that between IL Habits, and Confidence in IL Abilities. This indicates that students who are more confident in their abilities are reporting that their habits around IL activities are sound. However, this research does not demonstrate a correlation between IL Skills, Habits, and Confidence in IL Abilities. The lack of correlation between IL Skills, and Confidence in IL Abilities supports the finding of Maughan (2001) and O'Hanlon (2002), who reported that students overestimate their IL abilities. This research finding supports the caution by O'Hanlon (2002) that "College administrators must not assume that new students arrive with acceptable computing and research skills simply because students tell us that they are competent" (p. 8).

There has been no empirical research identified which has examined the correlation between IL skills and habits. This research did not demonstrate a correlation between IL skills and habits, which indicates that the student self-assessment of their Confidence in IL Abilities or IL Habits should not be used as proxy measurement for IL skill levels.

There are demographic differences demonstrated in our research findings that

follow trends recorded in the literature. Students with English as a second language (ESL) have a lower IL Skills score, indicate less sound IL Habits, and nominate less Confidence in their IL Abilities compared with their English as a first language class mates (Zoe and DiMartino, 2000). Contrary to the finding of O'Hanlon (2002), the females in our research group did not indicate a lower level of Confidence in IL Abilities, or demonstrate fewer IL Skills when compared with the males in the group. With the exception of one older student (over 35 years), IL Skills, IL Habits, and Confidence in IL Abilities increased with age. It was unfortunate that the limited group size did not support more detailed statistical analysis of demographic subgroups.

Universities in Australia and internationally are including information literacy in their graduate capabilities or attributes (Bundy, 2004; Johnston and Webber, 2003). Academics must consider how they can provide evidence of developing the graduate capability of information literacy. A tool such as the one used in this research can be used to monitor IL skill development both within courses and across programs of study, thus benefiting both program quality improvement and providing evidence of graduate-capability development.

## CONCLUSION

This project has resulted in the development of an evaluation tool that has enabled the demonstration of the level of IL Skills, the self-reported IL Habits of the students, and Confidence in IL Abilities of a group of students studying Medical Radiations. These factors have been mapped across the IL standards (Bundy, 2004) to build a profile of the group. This mapping can enable a teaching team to identify areas of strength and weakness relative to IL, and to target these for supportive learning and assessment tasks. It also provides evidence for lifelong-learning, graduate-capability development.

Evaluation at the beginning and end of the semester revealed positive changes in IL Skills, IL Habits, and Confidence in IL Abilities. The students were able, in the main, to articulate sound reasons for the importance of being information literate as both a student and a professional. Statements relating lifelong learning and information literacy revealed a clear appreciation by many students. Whilst there can be no causal associations made, results support the effectiveness of the IL learning and

assessment tasks the students are currently engaged with, and are being considered for adaptation into other parts of the Medical Radiations' program.

The results from this research have indicated that there is no correlation between the confidence the students may have in their abilities, and their skills, and we join others in recommendations that this should not be taken as the sole indicator of IL capability. This research also demonstrated there was no correlation between IL skill and IL habits which indicates that IL habits also should not be used as a sole indicator of IL capability. The positive correlations identified between Age, Academic History, Confidence in IL Abilities, and reporting sound IL habits are to be expected with a maturity of approach and increased successful experience at tertiary level.

There was no comparison of IL Skills, IL Habits, and Confidence in IL Abilities with academic performance in this research. However, use of this IL tool, embedded within the evaluation of a new foundation course in 2006, will investigate this link. Information from this evaluation project will provide academic staff with additional evidence of the academic impact of information literacy skills on student progress, and graduate capability development in the areas of information literacy and lifelong learning.

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