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How prepared are students for postgraduate study? A comparison of the information literacy skills of commencing undergraduate and postgraduate information studies students at Curtin University by Kate Conway.

Librarians and educators often assume that students entering university at the postgraduate level will have mastered basic information literacy skills during their undergraduate courses. This study was prompted by anecdotal reports from librarians and academic staff at Curtin University suggesting that this was not always the case. However, no evidence was available to confirm whether students indeed began postgraduate courses disadvantaged by a lack of basic skills such as the ability to read a citation, select an appropriate search tool, create an effective search strategy; or avoid plagiarism. This study aimed to shed light on this question, and in addition, to investigate other demographic variables which were considered likely to have a bearing on students' information literacy skills. These were: age, English as a first language, previous study or work experience, previous library instruction, Internet use and confidence.

LITERATURE REVIEW

Since the American Library Association (ALA)'s formal recognition in 1989 of information literacy as the ability 'to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information' (American Library Association 1989), the teaching of information literacy has become an increasingly important aspect of librarianship. particularly in academic libraries. This has been furthered by the codification of the skills noted in the ALA definition into sets of standards, including the Association of College and Research Libraries (ACRE) Information Literacy Competency Standards for Higher Education (2000), and the Australian and New Zealand Institute for Information Literacy (ANZIIL) standards (Bundy, 2004). These standards typically include the skills of recognising the information need, designing search strategies, retrieving and managing information, and then critically evaluating, synthesising and using the information to create new knowledge. The standards arc widely used as a basis for the teaching and assessment of information literacy in higher education.

The substantial amount of time and effort being expended by libraries on information literacy has led to demands from library managers and librarians for evidence that this is worthwhile. Many studies have been initiated with the aim of demonstrating the efficacy of library instruction in improving students' information literacy skills (Portmann & Roush, 2004; Shanahan, 2007). These studies have shown mixed results, with some finding no effect from library instruction and others demonstrating significant improvements in students' skills.

Over the same period, parent institutions have increasingly demanded accountability from the library services they fund (Salem & Radcliff, 2006: 131). This has led to the development of standardised, multiple choice tests suitable for accreditation and

benchmarking purposes. The most widely known of these tests is probably SAILS (Standardized Assessment of Information Literacy Skills!, developed at Kent State University in Ohio and based on the ACRL (American College and Research Libraries) standards (Salem & Radcliff, 2006). Similar tests include the ILT (Information Literacy Test) at James Madison University (Cameron et al., 2007), the South Dakota IL Exam (Leibiger & Schweinle, 2008), and the UMLTC (University of Maryland University College) test (Mulherrin & Husein, 2009). The ETS iSkills Assessment differs from other tests in that it measures ICT as well as information literacy skills, is scenario and problem-based rather than multiple choice, and purports to assess cognitive- as well as technical skills (Katz, 2007; Somerville et al.. 2008).

The question sets used in these studies are not published, but from descriptions of the tests, and the sample questions published in the literature, it appears that the skills being measured are, by and large, those described in the various information literacy standards which have been produced in the last twenty years. The questions used in the U.S. studies are generally based on the ACRL standards. For the most part, the tests focus on those aspects of the standards which describe what might be considered 'basic' skills and skills with using information resources. That is, the sort of skills required by undergraduates to research an assignment topic and reference their sources. In general, the tests do not include questions relating to the cognitive and writing skills needed to compose a paper. Both SAILS and ILT, for example, do no! assess ACRL Standard 4, concerning students' ability to use the information they have found. In addition, the ILT places greatest emphasis on Standards 2 (accesses needed information effectively and efficiently) and 3 (evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system), devoting two thirds of the test questions to these two standards (Cameron et al., 2007). This has led to some questioning in the literature as to the ability of these multiple choice tests to evaluate information literacy, as opposed to competence in the use of standard library tools.

The literature relating to SAILS and the other large-scale, standardised tests, focuses on the development and administration of these tests rather than on analysing the results, and there is little discussion of findings related to participants' information literacy abilities. The exceptions include a paper describing the ILL which gives figures for the percentages of students rated 'below proficient', 'proficient' and 'advanced' as 17%, 77% and 4% respectively (Cameron et al., 2007: 234) but does not elaborate further. Another paper informs us that students undertaking the ETS iSkills lest 'performed poorly.... achieving only about half of the possible points' (Somerville et al., 2008: 9) and had particular difficulties selecting research statements for assignments, in narrowing searches, evaluating the reliability of websites, and adapting material to the audience (Somerville et al., 2008: 10).

Since information literacy skills and use of library services have been linked to student retention (Blackburn. 2010: Ferguson et al., 2001), institutions have also been motivated to look more closely at the skills of commencing students. Papers describing these tests have concentrated on analysing students' skill strengths and weaknesses. In 2003, the University of Quebec library conducted a paper-based survey of incoming first year students, which was posted out to students in the vacation before they started their course. This consisted of 22 questions based

around 5 themes: concept identification; search strategy; document types; search tools and use of results. The stated aim of the study was to gain an idea of the level of information literacy skills of incoming undergraduate students, in order to inform the delivery of information literacy instruction and promote collaboration between the library and faculty (Millermeyer & Quirion, 2003). This study found that

students ability to retrieve information is hampered by their inability to identify concepts and to read citations, a lack of knowledge of the structure and contents of library catalogues and of controlled vocabulary, and deficient search Strategies (Mittermeyer & Quirion, 2003: 7). In this study, students gained an average score of 42%.

The Otago Polytechnic 'Curriculum Alignment Project' (Van Zijl et al., 2000) had similar aims and used largely the same questions. It replicated the Quebec study results, with students gaining an average score of 35% and lower scores on questions relating to encyclopedias, databases, catalogues, journals, and evaluating results. The TAKE Library and Information Skills Research Project (Stokes, 2005), used many of the same questions, although the aim of the study was slightly different, in that the test was used as a pre- and post-test measure to assess the outcomes of an information literacy intervention, l he average pre-test score of participants in the TAKE study was 54%, with students having particular difficulty with constructing search strategies, selecting search tools, and understanding referencing requirements and copyright.

Previous research has overwhelmingly targeted undergraduate students. The studies of postgraduate students which have been undertaken have tended to focus not on the level of skill, but on library use and resource needs of higher degree by research students (Fidzani, 1998; Hoffman et al., 2008; Barton et al., 2002; Bellard, 2005: Stein et al., 2006). The few studies which have examined postgraduate students' skill levels have generally concentrated on the extent to which these students are equipped for the special demands of higher degree research (Chu & Law. 2007; Kerins et al., 2004). In addition, there have been in-depth studies of the steps taken by students undertaking a literature review (George et al., 2006) and students' literature reviews have been studied as a means of" assessing their information skills (Boote & Beile, 2005; Silfen & Zgoda, 2008).

There is an absence, at the postgraduate level, of information literacy skills assessment involving the testing of basic skills. While a few studies have included basic skills assessment of postgraduates (Samson, 2000; Emmett & Emde, 2007; Perrett, 2004) or have declared that their tests could be used for longitudinal testing (Kent Slate University, 2010; Leibiger & Schweinle, 2008: 91), no studies specifically attempting to compare the skill levels of undergraduate and postgraduate students have been located in the literature.

Research methodology

The study was conducted by means of an online, multiple choice questionnaire administered through Survey Monkey. The author recognises the limitations of multiple choice tests, detailed by Oakleaf (2008) among others, in evaluating higher-order skills, and in reflecting real-world abilities, and considered other methods suggested in the literature, such as self-assessment or the self-reporting of skills

(Pinto, 2010; Small & Snyder, 2010; Thinners & Glas, 2010), analysis of the bibliographies of students' papers (Boote & Beile, 2005), and simulations of real-world tasks (Somerville et al., 2008). However, in the end, and following the example of previous information literacy skills tests, ease of administration and the need to collect quantitative data suitable for the comparison of undergraduate and postgraduate performance, won out over other considerations.

The questionnaire consisted of 2.") information literacy questions and, initially, nine demographic questions (with two additional questions included in the second round of the survey). The information literacy questions were designed to test students' basic information literacy skills, such as would typically be expected of first year students. One question was created (or selected from a previous study where appropriate) for each relevant ANZIIL outcome. ANZI1L Standard 5, which relates to the use of information to construct new concepts or create new understandings was omitted as being beyond the scope of a multiple choice test to evaluate. Previous studies have encountered similar difficulties in producing multiple-choice tests, with the ILT test not addressing ACRL Standard 4 for the same reason.

The decision to develop a new survey for this study, rather than using one of the existing tools, was based on a number of considerations. Most of the recently developed, large-scale tests were not discovered in the literature prior to the commencement of the study in mid-2008. In any case, these tests tend to be proprietary. That is, their questions are not made publicly available and they are not promoted as being available for use outside their own institutions. Alternatively, as in the case of SAILS for example, they may be used only under strict parameters. In addition, the large-scale tests are generally designed to be used as compulsory assessments and are described as demanding a significant investment of participants' time typically an hour or more . which the author considered to be unrealistic to expect from students participating voluntarily. Finally, there was a desire to base the questions on the ANZIIL Standards, which are the reference point for information literacy instruction at the Curtin University Library. While the recently developed, large-scale tests, such as SAILS, have not published their questions, except for some samples, they appear from descriptions in the literature to be mapped to the ACRL or other standards. The tests for which questions have been published, such as the Quebec and TAFE studies, are also not formally mapped to the ANZIIL standards. However, the author discovered that many, though not all, of their questions were suitable for testing those standards.

The decision was made to produce a new test, but to use questions, where appropriate, from those previous student surveys which had published their survey questions. These included the 2003 Quebec survey of incoming undergraduates, the Otago Polytechnic Curriculum Alignment Project Information Literacy Survey of 2005-6 and the TAFEWA Library & Information Skills Training Research Project of 2005. In addition, questions were drawn from the 'SIT and InfoTrekk tests administered to students completing Communication Skills units at Curtin University Library and based on the Library's InfoTrekk online information literacy skills tutorial (Curtin University Library, 2010).

A small pilot study was undertaken and some questions re-worded as a result to avoid the misunderstandings which became apparent during this testing. It would

have been desirable, if time and resources had allowed, to conduct a larger pilot study followed by a review of the validity and reliability of the questions. Large-scale studies which have aimed to produce tests to be used as high-stakes assessment or for benchmarking exercises, such as SAILS (Salem & Radcliff, 200(3) and the ILT (Cameron et al., 2007) have conducted such reviews but this was considered beyond the scope of this small study.

Having pointed out these deficiencies, it should be noted that by no means all of the previous studies reported in the literature, including the Quebec and TAFE studies, were validity or reliability tested and that many consisted of fewer questions than this study. In addition, most of the previous studies found were not consistently mapped to the ANZIIL standards.

The demographic questions were designed to explore factors which might have a bearing on a student's information literacy skills. These were: postgraduate/undergraduate status (the primary variable); age; English as a first language; Internet use; confidence in information literacy skills; prior study and work experience; and previous library instruction.

Participants were drawn from the population of commencing undergraduate and postgraduate students in the Information Studies Department at Curtin University. It was felt that these students, as future library practitioners, would be motivated to participate in the survey and therefore ensure a high response rate. Students were recruited by an e-mail containing a link to the questionnaire in Survey Monkey. The e-mails were sent out at the beginning of semesters one and two in 2009, with the survey running for the first few weeks of each semester.

The data were analysed to produce descriptive statistics and percentages were also used to illustrate findings in tables and graphs. No statistical tests were undertaken to determine the significance of the results obtained.

RESULTS

Completed surveys were received from 64 of the 147 students e-mailed, giving an overall response rate of 44%. The reasons for this fairly low response rate have not been investigated. It may be surmised that students were not prepared to devote the lime necessary for completing a survey for which they received no credit towards their courses. It is probable that, had a non-library studies group of students been chosen, or had a longer lest been used, the response rate may have been even lower.

Of the 64 respondents, 23 identified themselves as undergraduate and 41 as postgraduate students. There was a fairly even age breakdown amongst respondents, as can be seen in Table 1, giving quite small numbers in each group.

Of the respondents, 31 indicated that they had undertaken some form of previous library instruction (for example, participation in the library's various information literacy offerings, including library tours, online tutorials in library skills, and library skills workshops), while 16 had previous library work experience. All respondents reported feeling at least somewhat confident in their ability to use library resources effectively, with 18 of them being 'very confident'. Only four respondents reported

using the Internet less than a few times a week and only four indicated that English was not their first language.

On analysing the test results, postgraduate status, previous library work experience, confidence and age were found to have a bearing on performance. Postgraduate students scored an average of 77% as against 69% for undergraduates, with the average score for correct answers for all students being 73%. Students with exemptions from core units (an indication that they had previous relevant work experience) and students explicitly stating that they had library work experience performed better than those without. On average, these students scored 79% compared with an average of 69% for those reporting no work experience. Students who indicated they were confident or very confident in relation to their information literacy skills scored higher than students who were not very confident (an average of 79%, as against 64%). It is possible, however, that since the confidence question was posed at the end of the test, these results reflect participants' self-assessment of their performance in the test rather than their prior confidence in their abilities. The results showed age appearing to be a factor in performance, particularly for undergraduate students and albeit with the caveat of the small numbers involved (see Table 1) . Undergraduates in their 20s gained an average score of 81% as against 65% for those in their 30s. Previous library training appeared to have little influence on skill levels, with those reporting library training of any kind gaining an average score of 74%, as against 73% for those reporting no previous training and 67% for those reporting haying undertaken only a library tour but no other training, while the numbers indicating low frequency of Internet use and having a first language other than English were judged too small to draw conclusions.

Participants' performance in relation to the ANZIIL standards can be seen in Figure 1 which shows the average percentage of correct answers for both undergraduate and postgraduate students for each standard. It is noticeable that postgraduate students generally outperformed undergraduates.

[FIGURE 1 OMITTED]

While the overall performance of postgraduates in comparison with undergraduates was evidently superior, there were some interesting results relating to the performance of these groups against individual standards. It is noticeable, for example, that undergraduates performed particularly poorly on questions relating to ANZIIL standard 1.1 Defines & articulates the information need (identifies concepts from an assignment topic) and 1.2 Understands the purpose, scope and appropriateness of a variety of information sources (understands what types of material are found in books, journals & websites and when it is appropriate to use each of these sources). These are often assumed to be the 'easier' skills, which students are expected to master early in their undergraduate career.

In contrast, undergraduates scored marginally better than postgraduates on questions relating to Standard 6.3 Conforms with conventions and etiquette related to access to. and use of, information (understands what constitutes plagiarism) and Standard 2.3 Obtains information using appropriate methods (finds the full text of documents using appropriate tools and methods). These are skills at which it might have been expected that postgraduates would excel.

The scores for Standard 3.3 Revises search strategies as necessary were high, primarily due to the correct answers given by nearly all students in relation to broadening a search which has produced too few results. In contrast, nearly half of the undergraduate and a third of the postgraduate sample answered question 22, relating to narrowing a search, incorrectly.

There were some interesting results relating to participants' age. Counter-intuitively, younger students tended to gain higher scores on questions relating to traditional library resources, such as books and encyclopedias. Figure 2 presents the age breakdown for question 24, involving the method of finding a book chapter using a library catalogue, which was correctly answered by 52% of postgraduates and 48% of undergraduates.

[FIGURE 2 OMITTED]

Figure 3 shows the age distribution for responses to Question six, involving identifying an encyclopedia as the best source to consult in order to become familiar with an unfamiliar topic (answered correctly by 62% of postgraduates and 57% of undergraduates).

[FIGURE 3 OMITTED]

Finally, It is striking that the students in this stud)1 performed better overall than had students in previous similar studies, from which many of the questions used in the Curtin study were drawn (73% average as against 54% in the TAFE study (Stokes, 2005), 42% in the Quebec study (Mittermeyer & Quirion. 2003) and 35% in the Otago study (Van Zijl el al., 2006).

DISCUSSION

The most likely explanation for the superior performance of Curtin students lo those in previous studies is the difference in the populations being studied. Not only did the Curtin sample include postgraduate students, unlike the earlier studies, but the Curtin students also differed in being Information Studies students, on course to become librarians. In many cases these students had previously completed library-related vocational education courses and/or worked or volunteered in libraries.

Although the Curtin students scored higher than students in comparable studies, and postgraduate students scored higher than undergraduates (averaging 77% correct as opposed to 69% for undergraduates), it is interesting to note that a sizeable minority of students do not appear to have gained the basic skills required to locate documents in the course of their studies. This is evidenced by the poor scores of postgraduate students on questions testing these skills. As noted in the results, 33% of postgraduates were unable to identify a citation as indicating a journal article; 59% were unable lo select the best method of searching for a

specific journal article; 48% were unaware of how to find a book chapter using a library catalogue; and 33% were unable to identify the Boolean operator AND' as a means to narrow a search. One possible reason for this may be the widespread use

made in undergraduate courses of course readers, e-reserve, and direct links to articles from university learning management systems, which deliver students their required readings without necessitating the development of information searching skills.

It is a concern if students are completing their undergraduate study without the skills needed for successful postgraduate study or for lifelong learning. On the other hand, it may be argued that the importance of traditional library skills is diminishing, even for postgraduate students, with the introduction of a new generation of library catalogues, acting as single search 'discovery tools' which do not require distinct methods of searching for different types of materials and which return results by relevance, reducing the need for precise search strategies.

In addition to scoring poorly on questions designed to test document location skills, many students, especially undergraduates but also postgraduates, appear to have difficulties identifying concepts from an assignment topic and translating these into keywords. A sizeable proportion of undergraduates (66%) (and 32% of postgraduates) answered questions relating to ANZIIL Standard 1 Defines and articulates the information need correctly. Students' inability to define their information need could hamper their search for relevant material, although, as noted above, today's online information sources lend to be relatively forgiving of poorly constructed searches. There is also the possibility that students' lack of ability to understand assignment questions is a symptom of a deeper cognitive failure, as suggested by Perry (1985), which may lead to difficulties not only in finding relevant resources, but also in writing relevant assignments. The extern to which these problems can be improved by library instruction is debatable.

Perhaps surprisingly, participants' age appeared to have an association with test score. In particular, undergraduate students in (heir thirties scored lower overall than students in other age brackets, while students in their twenties scored particularly well. It is interesting that the poorer performance of older students held true even for questions relating lo the use of traditional library resources, with which one might have expected older students to have greater familiarity. In fact, 78% of students in their twenties answered the question on the use of encyclopedias correctly, compared with 39% of students in their thirties. These trends were evident even after accounting for the age distribution of postgraduates and undergraduates. Of course the small sample sizes involved limit the usefulness of these results and further study is needed to determine whether these findings are replicated on a wider scale.

It is perhaps disappointing that previous library instruction appeared to have no impact on test scores. In fact, participating in a library tour, with no other form of instruction, was associated with lower scores. Again, the reasons for this are open lo speculation. It is possible that in this particular study population, which included many participants with previous library work experience, those individuals who chose not to participate in library instruction were those already endowed with superior searching skills through their previous work experience.

Finally, it is important to note the limitations on the usefulness of these results caused by the lack of robustness of the survey tool. In addition lo the small sample sizes involved, scores for some questions may have been influenced by the difficulty

of, or confusion about, particular questions, rather than truly reflecting students' strengths and weaknesses. The small number of questions per ANZIIL standard and the lack of reliability or validity testing of questions has the potential to skew results considerably.

The limitations of multiple choice testing as a method of assessment for higher-order skills have already been noted. In fact, one of the main limitations of the survey tool used in this study is that it sought to test only basic, library-related skills, rather than the higher-order cognitive skills needed for true information literacy.

Finally, the lack of statistical analysis of the significance of differences in test scores between demographic groups is another reason for viewing these results with caution.

CONCLUSIONS

The principle aim of this study was to determine whether there was any difference in basic information literacy skills between postgraduate and undergraduate students. The study did find a difference, with postgraduates on average obtaining higher test scores than undergraduates. However, the postgraduate advantage of 8% was hardly overwhelming.

The most pronounced effect on test store was seen in relation to participants' age, with students in their twenties scoring an average of 81% and those in their thirties 65%, a difference of 16%. This effect held across postgraduate and undergraduate populations, but showed less variance for postgraduates.

Of the other demographic variables tested, only previous library work-experience and confidence were associated with higher scores. The study failed to find an association with performance from the ether variables tested, although the small size of the sub-samples render these results inconclusive. Further research in this area is needed to investigate these factors on a wider scale.

An analysis of students' performance on individual questions revealed that a sizeable minority had problems with skills often considered basic. These included: identifying key concepts from an assignment topic; recognizing material type from a citation; finding full text efficiently; using Boolean operators. These difficulties appeared to persist into postgraduate study and would have implications for these students" ability to pursue their studies effectively.

The conclusion may be drawn, with the caveats surrounding the validity of the test and small sample sizes already discussed, that postgraduate students cannot be assumed to possess all the basic information literacy skills necessary to succeed in their studies. This may prompt librarians and academic teaching staff to devote time to identifying and addressing gaps in their postgraduate students' knowledge. Finally, this study suggests that some older students may benefit from increased support from librarians and teaching staff.

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TABLE 1. Raw numbers of undergraduates and postgraduates in each age group

Age range	undergraduates	postgraduates	Total
Under 20	6	0	6
20-24	6	0	12
25-29	1	9	10
30-34	3	7	10
35-39	4	9	13
40+	3	10	13

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