Information Literacy: Diagnostics, Interventions, and Assessments

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Abstract
At the Temasek Polytechnic (TP) Library the librarians have been teaching Information Literacy (IL) and gathering feedback on these sessions for many, many years. While the students always profess to have enjoyed these sessions, what really needs to be ascertained is whether or not they have actually learned anything. The thought of trying to assess learning in hundreds of students may often be quite daunting, but a recent action research project at the TP library revealed how simple it can be. This study describes how this librarian used a diagnostic to measure prior knowledge, tailored the workshops according to the diagnostic findings, and then tried to assess how much the students had learned in the workshops. An added advantage came from the fact that the diagnostic, or pre-test, also showed just how much the Design students had remembered from their first library workshops.

Keywords*:*
information literacy, action research, design students, assessment, enduring impact, longitudinal studies.

Introduction

In the second quarter of 2017, the Deputy Director of the Temasek Polytechnic (TP) Learning Academy approached this librarian with an opportunity to participate in the Teaching in Higher Education Plus (THEC+) certificate program. As part of the polytechnic's strategy to continuously develop the professionalism of their teaching staff, the program requires the participants to complete an action research project and then share the findings. As the library had been teaching Information Literacy (IL) for many years, this was looked upon as the perfect opportunity to see how to further improve the library's programs. It was decided that the program for the Year One Design students be used for this project.

The Design program was chosen partly because the library had a long-standing arrangement to reach out to the Design students during all three years of their time at the polytechnic, and partly because the academic staff from this school are incredibly supportive. One of the reasons for this level of support for the library programs is the requirement by the Design school that their students use research to extend and enhance their creative experience. The Design students at TP need to become critical thinkers who can keep abreast of contemporary social issues and global trends while they are learning new skills. They also need to be able to market themselves and their products successfully, and to be able to make useful and knowledgeable contributions when working with industry partners.

The research findings for this THEC+ project, perhaps somewhat serendipitously, also served to reinforce the notion that Design students learn differently; a notion that is only quite recently starting to become an accepted one (Appleton, Montero, & Jones, 2017). Design students lean heavily towards the visual and kinesthetic learning styles, and they need the choice of being able to work things out within their own creative contexts (Payne, 2008). If you are going to ask them to give a presentation during the class, for example, leave the choice of presentation style up to them.

With regards to the action research component of the THEC+ study, what was required was that the students complete a range of questions (the diagnostic), and then the contents of the workshops (the intervention) were developed according to their answers to these questions. Of the two groups of students used in the research project, only the test group completed the diagnostic. In the end, after seeing 452 students in 15 workshops, getting them to take one multiple choice test, and then getting them to work together in groups on a one minute paper (Stead, 2005), it was found that the majority of the TP Design students were most certainly learning what their librarians were trying to teach (Wegener, 2018).

As a direct result of the THEC+ project, it was also found that the diagnostic, or pre-test if you prefer, was a super quick and easy way of discovering what the students needed to learn in their upcoming workshops. So in the interests of improving the library programs for a wider range of students, the THEC+ diagnostic/intervention approach was again applied; this time to the Year Two Design students just before they had to start work on a major assignment in their second semester. It was while doing this that it became apparent that the diagnostic was not only highlighting what the students knew but, and perhaps more importantly, also what they could remember from their first round of IL workshops.

And what they could remember turned out to be an average of 65% of what they had been taught. Not knowing whether to take this percentage as an indication of a successful outcome or a possible sign of failure, these findings signaled the advent of the second action research

project by this librarian and the subject of this particular paper. The main research question and hypothesis used were:

- To what extent are the workshops being offered to the Year Two Design students at Temasek Polytechnic helping them increase their IL skills?
- Changing the lesson plan according to the diagnostic findings will have a positive effect on the student IL scores.

An additional research question involved the 65% retention rate. Was this a bad thing, or did it indicate that the librarians were actually doing a good job? With this in mind, the literature search began.

Literature Review

Information Literacy Assessment

A quick review of the literature focusing on recent studies identified a few that helped to provide an overview of the state of assessment in IL instruction, albeit mainly in the United States. Sobel and Sugimoto (2012) surveyed a sample of 400 American academic libraries and found that most of the assessment tried to measure what the students had learned during a single session. Most of the libraries also indicated that they used more than one assessment tool. These tools consisted of quizzes administered at various times before and after the instruction sessions; worksheets; course assignments; and student assignments that were submitted at different times ranging from days to weeks after the library session. Quizzes were used the most often, with 61% of the libraries in this study utilizing quizzes to assess student learning (Sobel & Sugimoto, 2012).

In 2016, a study conducted by Julien, Gross, and Latham (2018) found that less than 50% of their 622 academic library respondents in the United States had any formal instructional objectives. This meant the outcomes of any assessments would therefore be largely uncertain. Survey respondents in this study admitted that 58% of their assessment of student learning came from feedback from their academic staff, 41% from quizzes, worksheets and other types of formative assessment, and 40% from "student self-assessment" (Julien, Gross, & Latham, 2012, p. 186).

The authors of this same study also mentioned that the assessment practices in Canadian academic libraries were very similar to those in the United States, although formal instructional objectives could be found in even fewer libraries in Canada (Julien et al., 2012). Another study, this one concentrating on 517 online tutorials from 52 academic libraries and conducted in 2017, revealed that only about 20% of the tutorials attempted to assess if any learning had taken place (Saunders, 2018). What little assessment there was mostly took the form of quizzes and worksheets.

The picture painted by these reviews of the assessment of library instruction over recent years was not a very positive one. Experience and research have shown that it is vital to constantly assess teaching because it needs to be ascertained whether or not the students are actually learning anything. And if they are not learning, the librarians' efforts are being wasted, so the programs need to be adjusted. Of course, it is also becoming more and more important that librarians 'prove' to their institutions that their programs are indeed having a positive impact.

Fortunately, in 2018 the situation with library instruction assessment seems to have improved, at least as reported in the United States and Canada. Erlinger (2018) reports that Classroom Assessment Techniques (CATs) were being used in 53% of the American

undergraduate programs in her study. She reported librarians using clickers or one minute papers, for example, to get the students to show how much they had learned (2018).

The next most often used form of assessment, according to Erlinger (2018) were surveys that measured the thoughts and feelings of the students. Not to be taken lightly, the survey as a method of assessment can be very useful because, as pointed out by Creaser, "high levels of satisfaction with user training are likely to be linked with the acquisition of relevant skills" (2018, p. 89). The more satisfied the students say they are, the more likely they are to have learned something.

Enduring Impact

Three of the papers in the study by Erlinger reported having used "longitudinal post-post-session surveys" to see if the students had carried the IL skills learned beyond the library sessions (2018, p. 448). A number of other fairly recent studies were also found on the enduring impact or retention of IL skills from library programs. These studies looked at various IL programs offered to both undergraduate and postgraduate students where librarians were measuring student perceptions, as opposed to testing the students' actual knowledge or skills. Perceptions were measured after delays of up to two years and retention rates ranged from 66% to 83%. Table 1 compares the main points of these studies, where the perceived retention rates ranged from 66% to 83%. The only problem here, however, is that the students may perceive themselves as more knowledgeable that they actually are.

	Course	***Students type***	***Student numbers***	***Delay period***	***Perceived Retention rate***
Hong Kong University of Science & Technology - Wong, Chan, & Chu, 2006	Various IL programs	undergraduate, postgraduate	4,223	4-8 weeks	69%
Louisiana State University (US) - Daugherty & Russo, 2011	Research methods & materials, LIS 101	undergraduate, postgraduate	326	1-3 years	76%
Technical University of Munich (Germany) - Hohmann, 2014	Introductory IL course, Advanced IL course	undergraduate (ug), postgraduate (pg)	144	6-24 months	71% (ug), 83% (pg)
Muhimbili University of Health and Allied Sciences (Tanzania) - Lwoga, 2014	First Year IL program	undergraduate	275	11 months	66%

Table 1. Institutions using delayed retention to measure perceptions

A few other studies were found where the assessment went beyond student perceptions, to the actual measuring of the long-term retention of student skills and knowledge. Among Business and Psychology undergraduate students, it was found that, after a while, the IL skills retention rates ranged from 65% to 75%. The number of students involved in these three studies was not very large, but the results are certainly encouraging as the students seem to be

remembering a significant portion of what the librarians are teaching. The findings of these papers are summarized in Table 2.

	Discipline	***Students type***	***Student numbers***	***Delay period***	***Retention rate***
Oakland University (US) - Hristova & Miree, 2013	Business	undergraduate	100	3 years	75%
Universities of Ljubljana and Maribor (Slovenia) - Kavšek, Peklaj & Žugelj, 2016	Psychology	undergraduate	86	a few months	65%
"large Midwestern University" (US) - Stonebraker & Fundator, 2016	Business	undergraduate	38	months to years	65%

Table 2. Institutions using delayed retention to measure skills & knowledge

Although in the Stonebraker and Fundator study outlined in Table 2 the researchers were more concerned with looking at scaffolding in IL classes (2016), what was interesting was the fact that those students who attended their second IL course scored an average of 65% on the post-test. A gratifying parallel could be drawn here in that the Design students at the Temasek Polytechnic scored an average of 12% higher on the post test for their second IL course. Of course, there are many different variables at play here. If, as highlighted by Sobel and Sugimoto (2012), most librarians have taught themselves to develop assessment techniques, the efficacy of these techniques may vary slightly, which may make any comparisons slightly less than accurate.

While not exhaustive, what this review did provide was an indication of where library instruction assessment is heading in the United States and Canada. And, by the looks of things, the rest of the world is either following or even leading in the same direction. This brief review also shows the relative scarcity of research on testing the enduring impact of IL skills, as well as what range of scores to expect in this area. With the enduring impact range of IL skills found here being between 65% and 76%, the Year Two Design sessions at TP do not seem to be doing too badly. The 65% skills retention rate at Temasek Polytechnic being more of an indication of success than of failure, perhaps?

Methodology

Action Research

For those not familiar with the concept of action research, there are a number of different approaches one can take. The approach most commonly used by librarians, according to Jefferson (2014), and the one used in the studies at the Temasek Polytechnic on the Design students, is that of participant action research. This approach can be broken down very simply into the following steps:

1. Identifying an issue or problem, using a diagnostic, for example.
2. Planning the action to be taken.
3. Implementing the action or intervention.
4. Collecting, analyzing, and evaluating the data.
5. Sharing the findings in some way.

> One of the most important points to be noted about action research, however, is that it is not a once-off endeavor using a single intervention to solve a problem. What action research does is follow a spiral of planning, acting, monitoring, evaluating, and then starting all over again. At its best, it becomes a more or less constant process of understanding, improving, and making changes to one's teaching practices (Vezzosi, 2006).

The Approach

The Design School at the Temasek Polytechnic used to use a block timetabling system where the students attended classes that were longer in duration but fewer in number over a specified "block" of time. This means that the librarians got to see all the students from an annual intake, just at different times over the course of the year. The data for this study was gathered from 43 students during the April 2018 block, and 101 students during the July 2018 block, with a response rate of 18% and 48% respectively. Roping in the assistance of the Design tutors in July helped increase the response rate quite substantially.

Unlike the research project involving the Year One Design students (Wegener, 2018), only two methods of assessment were used for the Year Two students, in part because it was felt that the students needed to concentrate on their assignments, and in part because the major focus in this case was on using the diagnostic to adjust the workshop lesson plans accordingly. The first method of assessment took the form of pre-test and post-test questionnaires designed to get the students to either tell the librarians or show them what they could remember about IL skills. The questions in the post-test were ordered and phrased slightly differently from the questions in the pre-test or diagnostic.

Every effort was made to include in the tests both Levels 2 and 3 of Kirkpatrick's four levels of library instruction. In other words, what the students have learned and remembered, and how they put this into practice (Turnbow & Zeidman-Karpinski, 2018). The second method of assessment was combined with the post-test. It took the form of a single mini survey question designed to gauge the students' perception of the workshops; dealing with student satisfaction and the first of Kirkpatrick's four levels.

<u>The Diagnostic</u>

An email was sent to all the students one week before the start of the workshops. They were asked to complete a questionnaire with the explanation that this was so the librarian could tailor the workshops to make them more practical and relevant to student needs. Dunaway and Orblych elected to send out their request to their students two weeks earlier (2010), but it was found to make more sense for the Temasek Polytechnic students to be asked to help the librarians prepare for "next week". Too long a time gap and the Temasek Polytechnic Design students either would not see the point, or would quickly lose interest.

The questionnaire, or diagnostic to use the action research term, consisted of 10 multiple choice questions designed to test the student knowledge on the following topics:

- Search strategies, including Booleans.
- Plagiarism and citing according to the American Psychological Association (APA) citation style.
- Identifying the difference between primary and secondary resources.
- Evaluating sources of information using the CRAAP test to look at currency, relevance, authority, accuracy, and purpose.

One of the questions was subsequently changed after the April session because, when it comes to the best place to find research published by scholars and experts, in some cases the correct answer could quite conceivably be "Google Scholar". As a result, for the April sessions, both Google Scholar and the Library databases were accepted as being the correct answer to the question of the best place to find scholarly research. The remaining two questions were asked to find out what they perceived to be the greatest obstacles they faced when conducting research, and also if they had ever used a reference manager.

The Intervention

Once the responses were received, the lesson plan was developed for the intervention. As the Temasek Polytechnic librarians have been teaching the Design students for many years, this was a simple task in that all that really had to be done was to cut down on the time spent on searching the library databases, and increase the time taken during the workshops on evaluating information and using in text citations correctly. Using the tutorial times so generously allocated to the library by the Design tutors, 11 sessions were then held in April and the same number of sessions again in June.

At the end of each class the students were asked to compete the post-test and the mini-survey, and the post-test scores were compared with the scores of the same students who completed the diagnostic before the workshops. As some of the workshops ran concurrently, this author would like take the time here to acknowledge the wonderful services of TP library colleagues Georgiana Glass and Mustafa Mahadi who so graciously stepped in to help with the teaching.

Findings

In April 2018, 237 students attended the 11 workshops and 43 students completed both the diagnostic and the post-test. In July 2018, 211 students attended the same number of workshops, with 128 students completing the diagnostic, and 211 taking the post-test. Of the 43 students who completed the diagnostic or pre-test in April, the average score was 65%, indicating that they remembered an average of 65% of what they had learned in their Year One IL sessions. Of the 101 students who completed both the diagnostic and post-test in July, the average score was also 65%. In addition to this, both the April and the July groups expressed a satisfaction rating of 95%, agreeing that the workshop helped increase their understanding of library research skills. Table 3 shows these numbers at a glance.

The fact that both groups of students had the same diagnostic or pre-test score averages somewhat alleviated the fears of the author as to the validity of a multiple-choice test. Although quick and easy and often used to measure learning in library programs, multiple choice testing is considered by many to be the least efficient way of testing higher level thinking skills. It is also this author's experience that Design students do not respond all that favorably to this type of testing. However, as these marks were not going to count for the overall class grade, the intention was not to take up too much of the students' time with more complicated methods of assessment.

	Diagnostic or pre-test completed	*Average diagnostic or pre-test score*	*Intervention or workshop attendance*	*Diagnostic & Post-test completed*	*Post-test score*	*Satisfaction rating*
April 2018	18% (n=43)	65%	237	18% (n=43)	78%	95%
July 2018	61% (n=128)	65%	211	48% (n=101)	76%	95%

Table 3. Attendance and test completion figures

The t-test as outlined in Table 4 showed very clearly that the p-value for the test scores for both groups of students was substantially less than the all-important 0.05 significance level. In other words, the intervention or customized workshop did indeed have a positive effect on the student IL scores. Although the differences between the diagnostic and the post-test scores were quite substantial, out of curiosity, Cohen's D was used to further measure these differences. With scores of 0.89 for the April group and 0.70 for the July group, it became apparent that with such a large effect size, the intervention undoubtedly had a positive effect on the IL scores of the students.

				95% Confidence Interval	
	average diagnostic or pre-test score	**average post-test score**	**Cohen's D**	**mean**	**p-value (two-tailed)**
April 2018 (n=43)	65%	78%	0.89	8.63	0.000007
July 2018 (n=101)	65%	76%	0.70	8.43	0.02

Table 4. Cohen's D & Two-tailed t-test on two samples assuming unequal variances

Discussion

The first batch of Design students to receive the action research treatment in this study in April 2018 provided an experience that produced some very valuable learning points:

1. If no grades are involved, even if the librarian resorts to multiple reminder emails, the active support of the Design tutors is a must.
2. Google Scholar is becoming better at providing access to reliable scholarly articles and, for various reasons, will often be seen by the students to be on a par with the library databases.
3. A diagnostic can completely change one's original instructional objectives.

On this third point, of the four existing learning outcomes or objectives for the Design Year Two library program, one objective needed to be dropped, and two more had to be added, namely:

1. Use the CRAAP test to evaluate information found in terms of currency, relevance, authority, accuracy, and purpose.
2. Use in text citations to correctly identify the author, publication year and page numbers of citation in the reference list.

The objective that was dropped involved the development of strategies to effectively search the library databases. Not many years ago the students at the Temasek Polytechnic may have needed detailed instructions on how to search each different database, but this is no longer the case. Databases are becoming easier to search; students are now digital natives who have never known a world without technology. It has also been found that the Design students in particular respond far more favorably to directions in class that look something like this:

- Find a case study from WARC
- Find a report from Worth Global Style Network
- Find a journal article from Science Direct
- Highlight the differences between these 3 library databases
- Explain which one is your favorite database in a brief presentation.

This type of approach allows to the students to follow their own learning paths, and is based very loosely on the concept of productive failure. In a recent keynote address on productive failure by Manu Kapur at the 2018 TP Learning Academy Fest, this librarian was struck by his assertion that that one does not usually tell a child how to play with a toy. This statement immediately brought the TP Design students to mind because what has been found to work best with these students is to start off by treating the databases like toys and "handing them" over to the students with no instructions on how to play with them.

If the students are allowed to work in groups, and then to present their findings to the rest of the class on how they "played with their toys", the librarian can stand aside and simply watch the incredible amount of learning that takes place. To be a facilitator and be able to guide these students along the varied paths of their learning journeys is far more satisfying than standing up in front of them and putting them to sleep by talking too much.

Conclusion

This research project was started in response to the results of a previous study using Design Year One students where it was found that a diagnostic was an extremely useful way to tailor a library instruction session to meet the needs of the students (Wegener, 2018). The main question driving the project in this paper was:

- To what extent are the workshops being offered to the Year Two Design students at the Temasek Polytechnic helping them increase their Information Literacy skills?

The answer to the question was that the workshops were helping the students increase their IL skills to a gratifyingly large extent. In addition, as the study progressed, it was found that, while the diagnostic was helping to ensure the IL skills of these students be increased in a way that was statistically significant, the diagnostic was also serving more than one purpose. As well as helping the librarian customize the sessions, the diagnostic was:

- letting the students know what to expect in the upcoming workshop; and
- alerting the librarian to what students could remember from prior library sessions.

As suggested here, an action research diagnostic coupled with a post-test is a quick and easy way to improve one's teaching by helping to focus on what the students need to learn, and to measure this learning. Of course, this study does have its limitations. It would have been preferable, for example, to use a more diverse range of assessment methods and move firmly beyond the first level of Kirkpatrick's four levels of instruction to look at higher order thinking skills, but this librarian would be the first to acknowledge that this is not always possible.

No librarian would dispute the importance of library instruction, but it is becoming increasingly apparent that shrinking budgets and the increasing ease with which information is being made available has made the assessment of library instructional programs even more important. Librarians need to justify their existence, while still making sure to equip the students as best they can to cope with the changing information climate. The onus is on the librarians, therefore, to persevere, to make their workshops more relevant to the students, and to add to the growing trend in successful assessment to show the non-believers out there how good librarians actually are at what they do.

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