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ABSTRACT

Two instruments were developed to elicit information about students' abilities and their instructional needs in finding information in a library. Tests of student skills were developed through a series of empirical trials and reviews. The third trial of the test was carried out by using whole classes selected randomly to yield two classes from four schools for each test. Results show that the developed elementary (grades 5 and 6) and intermediate (grades 7 and 8) tests are sufficiently reliable to proceed to national standardization. The tests for secondary school students has many difficult items, and will require further developmental trials before national standardization. Test results show that girls score higher and are rated higher than boys, and that students in high-performance schools ("high decile") score better than those at low and middle levels of performance. Older students also tend to do better than younger ones. The tests seem to be moving in the right direction in terms of their ability to discriminate reliably among candidates, and they should permit teachers to make informed decisions about the learning needs of a wide variety of students. (Contains nine tables, four figures, and two references.) (SLD)

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Assessing an essential skill:

Finding information in the library

Success in information literacy partly requires accurate and independent ability to locate items in libraries. This paper reports on the author's exploratory work in developing school-based assessments in library skills. Direct tests of student knowledge and teacher observational ratings of student independence have been developed. The paper will describe how library skills have been defined and sequenced for primary (Y5-6), intermediate (Y7-8), and secondary (Y9-10) stages. Findings on the reliability and validity of the assessments at all levels will be discussed. Specific questions to be addressed include:

- What role do gender and decile play in test performance and teacher observation?
- What differences are there in achievement in understanding catalogues and locating items in a library?
- What agreement is there in library skills achievement as measured by test scores and by teacher observation?

In a paper (Brown, 1997) given at the 1997 NZARE conference I discussed information skills in the New Zealand curriculum framework and foreshadowed some types of assessment instruments that could be developed to assist classroom teachers in teaching information skills. This paper follows the development of two instruments designed to elicit information about students' abilities and their instructional needs in finding information in a library. These two instruments are part of a collection of direct tests, teacher rating schedules, and student self-reports (Table 1) that are being developed or planned for phased publication in 1999. Three levels of the test are in development (ie. primary, intermediate, & secondary), and one teacher rating schedule across the three levels is planned.

As NEMP's research last year (Crooks & Flockton, 1998) pointed out students generally find information easily but struggle to know how or why to make use of the information. Nevertheless, in a battery of assessment instruments it is still useful to identify the architecture of a student's understanding of library systems and their purposes and it is toward that goal that these instruments have been developed.

Instruments

The tests and rating schedule have been developed through a series of empirical trials and reviews (Figure 1). This process has allowed refinement of several dimensions of the instruments; the wording of the questions, the layout and ordering of items, the validation of the tasks and stimulus material against school library realities, determination of the difficulty and discrimination of each item, and the sequencing of the information skills curriculum under-girding the instruments. This last dimension has been most crucial since detailed expectations of achievement standards do not yet exist for information skills. The three levels of the test act as a *de-facto* statement of the minimum content which students could be expected to master.

The content of the test is broken into four major aspects of library systems that assist library users to locate and make use of information (Table 2); the catalogue, library sections and shelving, and evaluation of sources.. Some aspects of knowledge are tested early on and disappear from the test criteria as children age; for example library sections. Some aspects of knowledge (eg. the world wide web and evaluating the authority of sources) are introduced later as students develop the reading and information experience needed to handle the questions. Other dimensions remain important across all three tests; that is knowledge about Dewey decimal system and the use of key words. The development or sequencing of these systems is also marked by increasing the amount and complexity of information that students have to handle in order to answer the questions. The type of response required of students also contributes to increasing difficulty; multiple-choice questions are easier in general than constructed responses. To illustrate these points a very small sample of items on the use and structure of the Dewey decimal system, with results, show an increasingly demanding curriculum expectation (Figure 2).

. It should be kept in mind that these sequences are valid only for the condition of being asked to produce knowledge in a pen & paper, independent, on-demand test situation. Obviously, teachers will instruct, model, and support children in understanding these content demands much sooner than students could be expected to answer written questions independently. Thus, the three tests can indicate to teachers the areas of library knowledge students should be able to handle by the end of years 6, 8, and 10 respectively if students are to make effective use of the library to meet their own information needs.

Throughout the design and construction of these instruments emphasis has been put on the fact that all library systems, structures, and procedures exist to enable users to solve information problems. The kinds of problems users have include:

- Does this library have any information pertinent to my problem?
- What information can I get from the catalogue to help solve the problem?
- How do I structure my problem in terms of library systems?
- Where is the information I want?
- What form is the information in?
- What procedures do I use when things go wrong (eg. there's too many sources, a source isn't where it's supposed to be, and so on)?

Thus, the tests elicit responses which show that students can both exhibit knowledge of the library system itself and knowledge of how to use the library system to meet certain information problems.

In addition to the tests, a teacher rating scale has been in development. This scale identifies 11 problem situations commonly faced in the process of using catalogues and locating information in a library (Table 3). All of the situations, bar knowing how to use the catalogue technology, are covered to some degree by test items. Teachers rate students on the quality of independence they have observed students exhibiting in the problem situations. This scale has the capability of helping teachers identify students who may be able to locate information despite their inability to score well on the test.

Method

The third trial of the library skills test was carried out by post using whole classes selected randomly according to the certain criteria concerning decile, and location (Table 4). In effect, this provided two classes from four schools for each test with one school each at low (1-3) and high (8-10) decile ranges and two schools for the mid (4-7) decile range. However, when relying on the good will of others at a distance best laid plans do go astray and numbers do not quite match up with the plan.

Each test is analysed using ConQuest statistical package to determine item difficulties and discrimination, as well as overall test reliability.

In order to validate the teacher rating scale, teachers were asked to rate every second student taking the test. Despite this plan going even more astray in terms of data collection, sufficient data was captured to carry out a variety of multi-variate statistical analyses using SAS.

Results

The primary and intermediate tests (Tables 5) are sufficiently reliable to proceed to national standardisation with coefficient alpha scores of 0.91 and 0.87 respectively. This is quite respectable internal consistency given the low number of items, again 35 and 33 respectively. Bar some minor modifications, these two tests are sufficiently robust technically to proceed to standardisation. The secondary test has a significant number of extremely difficult items, especially those that require students to fill out a search field accurately (Figure 3), and will require further trialing prior to standardisation.

Pearson Correlation coefficients (Table 6) indicate a small number of statistically significant relationships within the data set.

- Gender has a positive though weak correlation with all three measurements; ie. females tend to do better on the test and tend to be rated higher for catalogue and location skills.
- Test version and year have weak negative correlations with test score and catalogue rating. This indicates that catalogue ratings and test scores have a small tendency to decrease with age; perhaps suggesting that the tests are increasingly harder.

- Decile has a weak positive correlation with test score alone implying that students from higher decile schools perform better on formal paper and pencil testing.
- The assessment instruments correlate quite well with each other. The test score has a moderately strong positive correlation with the two ratings while the two ratings are strongly correlated with each other. This implies that while the two rating scales are measuring more or less the same characteristic as each other they are, as might be expected, measuring a somewhat different trait than the test.

Analysis of means (Tables 7) produces similar results. There is no statistically significant difference across the three levels in terms of location rating. Likewise no difference exists between the secondary and intermediate tests and ratings results. However, the primary test and catalogue rating are significantly different from the other two levels. Statistically significant differences exist in favour of the high decile group test results only; there are no statistically significant difference for the ratings across all decile levels. Perhaps unsurprisingly, differences for the test and both ratings between boys and girls are statistically significant in favour of the females. For test scores the impact of decile on gender is interesting (Figure 4); girls at low and mid-decile groups are very close to each other before stepping up to the high decile girls; whereas boys' scores increase across each decile group.

Multiple analysis of variance statistics (Tables 8) clearly indicate that the data is explained best by the separate main effects of decile, school year, and gender. The test scores are driven separately by all three demographic variables; while the two ratings are both driven by gender differences only. The only overall significant interaction, which explains the data after accounting for the main effects of decile, school year and gender, is that of year and decile, in other words scores rise as both the year and the decile rises.

A principal components analysis (Table 9A) clearly shows that after the measurement variables, school year, decile, and gender, shape the next 3 descending components resulting in four components that explain over 90% of the variance. School year and test version are proxies for increasing age of students. A principal factor analysis (Table 9B), which reduces the correlation matrix by removing the uniquenesses, simplifies the data structure to two factors. The first factor loads heavily on the two ratings, moderately on the test score, and weakly on gender. The second factor loads heavily on test version and school year or age.

Conclusions

This data analysis tells a relatively simple, yet powerful, story about children's library skills. Girls score higher and are rated higher than boys. Students in high decile schools receive higher test scores than those at low and mid-decile schools. Older students tend to do better than younger ones. And yet, this is not the whole story. The fact that the students are not truly randomly sampled, due to the cluster effect of testing whole classes, may suggest that what looks like a decile effect may be a school or teacher effect that could be replicated in other schools.

It appears that the tests are moving in the right direction in terms of their ability to discriminate reliably among candidates. More importantly, they will permit teachers to make informed decisions about the learning needs of a wide range of students. As well the teacher rating schedules, while measuring differently from the tests, give an insight into student behaviour that coincides, quite strongly for consensual validation, with the test scores. It is possible that the rating scales might be successfully used as a substitute for the test.

References

Brown, G. (1997). *Information skills in the New Zealand curriculum: A blueprint for education?* Paper presented at the NZ Association for Research in Education Annual Conference, December 4-7, 1997, Auckland. [On-line]. Available: http://pakuranga.school.nz/asla.html/gbrown.html

Crooks, T., & Flockton, L. (1998). *Information skills: Assessment results 1997.* National Education Monitoring Report 7. Dunedin: University of Otago, Educational Assessment Research Unit.

Table 1: NZCER Development Plan for Information Skills Assessment Instruments

	Plan	Find							Comprehend								Utilise/Apply				Present			Evaluate	
		Library			Parts of Books		Reference Books		Seeking Information		Maps / Diagrams			Tables / Graphs			Evaluating Information		Oral	Visual	Written	Process	Outcome
Level		P	I	S	P	I	P	I	I	S	P	I	S	P	I	S	I	S					
Test		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Performance Task(s)		✓	✓	✓																			
Teacher Assessment	✓	✓					✓		✓								✓		✓	✓	✓		✓
Self-Assessment	✓	✓			→		→		→					→			→			→		✓	
Peer Assessment																			✓	✓	✓		

Status by end 1998

Trial 3 completed: Standardisation early 99	✓
Trial 2 completed: Standardisation 99	✓
Trial 1 completed: Standardisation mid 99	✓
Pilot stage: Standardisation mid 99	✓
In Writing/Review: Standardisation mid 99	✓
Yet to commence	✓

Table2: Content Analysis: Library Skills Tests

Numbers are the question numbers in each test

Topic	Primary	Intermediate	Secondary
Catalogue Use			
Author	10, 22, 23, 27, 31, 32	19, 21	11, 23
Dewey Number	11, 13, 20, 23, 24, 28, 29, 30, 34	15, 17, 18, 21, 22, 23, 24, 26, 27, 28, 29	5, 8, 9, 22, 27, 28a, 28b, 29
Item Format		3, 8	
Publication Place		5, 16iii	
Publication Year	21, 22	6, 16v	4
Publisher		9, 16iv	
Subject / Key Words	12, 14, 15, 16, 17, 18, 20, 26, 29	1, 7, 11, 12, 13, 14	6, 7, 9, 13, 14, 15, 18, 20, 22, 24, 26, 29
Title	9, 18, 19, 21	16ii	7, 25
Library Section			
Big Book	5		
Catalogue	8		
Fiction	1, 7, 33	2, 20	8
Non-Fiction	3, 6, 11, 35	17, 18, 30	
Reference	2, 4		1
Vertical File		10	
World Wide Web			19, 21
Library Location			
Search Procedures	25	11, 13, 14, 15, 22, 24, 25	16, 22, 23, 24, 25, 26, 30
Shelf / Bay	23, 29, 30, 31, 32, 34	17, 18, 19, 20, 23, 26, 27, 28, 29	11, 13, 27, 28a, 28b, 29
Signposts/Maps	1, 2, 3, 4, 5, 6, 7, 8		
Spine Labels	28, 29, 30		5, 27, 28a, 28b, 29
Evaluation of Sources			
Authority			19, 21
Completeness			2
Comprehensibility		4	3, 17
Currency/Recency	21, 22	6	4
Relevance			18

Table 3: Teacher Rating Form - Independence

Situations	Likely Response	Likely Response	Likely Response	Likely Response.	Likely Response
Understanding the Catalogue	*Works independently.*	*Seeks help only after some effort.*	*Seeks help before own effort.*	*Works is unfocussed.*	*Work is abandoned.*
1. **Knowing how to use the catalogue.**	Uses the on-line or printed help materials.	Help after effort.	Help before effort.	Starts aimlessly playing with catalogue.	No effort.
2. **Understanding the catalogue entry information.**	Refers to on-line or printed help materials.	Help after effort.	Help before effort.	Starts browsing the shelves.	No effort.
3. **Finding too much material from the catalogue.**	Refines list by using narrower search terms or limiting tools.	Help after effort.	Help before effort.	Deals with the whole list or just the first few items.	No effort.
4. **Finding no appropriate items.**	Restarts with a different search terms.	Help after effort.	Help before effort.	Uses inappropriate items anyway.	No effort.
5. **Finding a mixture of relevant and irrelevant items.**	Sorts out and uses relevant items only.	Help after effort.	Help before effort.	Uses irrelevant items anyway.	No effort.
Locating Items on the Shelf	*Works independently.*	*Seeks help only after some effort.*	*Seeks help before own effort.*	*Works is unfocussed.*	*Work is abandoned.*
1. **Knowing where the correct section is.**	Refers to the library map, sign posts, or other guides.	Help after effort.	Help before effort.	Starts browsing.	No effort.
2. **Knowing on which shelf the material is.**	Follows shelf guides & spine labels in correct order.	Help after effort.	Help before effort.	Starts browsing.	No effort.
3. **Using other relevant items when the item looked for is not on the shelf.**	Browses related items on the shelf.	Help after effort.	Help before effort.	Starts browsing.	No effort.
4. **Finding a 'non-book' item.**	Checks the catalogue for its proper location.	Help after effort.	Help before effort.	Starts browsing.	No effort.
5. **Finding an item that has been checked out of the library.**	Places a 'reserve' on the item.	Help after effort.	Help before effort.	Starts browsing.	No effort.
6. **Finding items that are inappropriate, (eg. too general, too technical, etc.).**	Browses for other related items on the shelf.	Help after effort.	Help before effort.	Uses inappropriate material anyway.	No effort.

Table 4: Sampling Design Parameters - Trial 3 Postal Method

Level	Primary		Intermediate		Secondary	
Year	*5*	*6*	*7*	*8*	*9*	*10*
Number	100	100	100	100	100	100

Gender	*Male* 50%	*Female* 50%

Decile	*Low* (1-3)	*Middle* (4-7)	*High* (8-10)
	25%	50%	25%

Area	*Rural/Small Town*	*Provincial Cities*	*Major Urban*
	25%	25%	50%

Table 5A: Primary Library Skills - Test Results

	Trial3	Trial 2	Trial 1
N	184	106	113
Time	T4 98	T3 98	T2 98
Year Level	5 & 6	5	6
# Items	35	40	31
Average	19.8 56.7%	15.0 37.6%	14.1 45.5%
Std Dev	8.01	7.34	5.69
Std Err Avg	.50	.71	.54
Std Err Meas't	2.46	2.73	2.38
Coefficient alpha	.91	.86	.82

Table 5B: Intermediate Library Skills - Test Results

	Trial3	Trial 2	Trial 1
N	237	124	100
Time	T4 98	T3 98	T2 98
Year Level	7 & 8	7	8
# Items	33	34	28
Average	16.4 49.6%	15.3 44.9%	14.6 52.1%
Std Dev	6.79	6.14	4.59
Std Err Avg	.44	.55	.46
Std Err Meas't	2.47	2.52	2.23
Coefficient alpha	.87	.83	.76

Table 5C: Secondary Library Skills - Test Results

	Trial3	Trial 2	Trial 1
N	178	94	97
Time	T4 98	T3 98	T2 98
Year Level	9 & 10	9	10
# Items	31	32	32
Average	17.2 55.3%	15.2 47.6%	17.5 54.6%
Std Dev	5.56	5.7	5.06
Std Err Avg	.42	.59	.51
Std Err Meas't	2.38	2.38	2.33
Coefficient alpha	.82	.83	.79

Table 6: Correlation Analysis

(Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0 / Number of Observations)

	SEX	TVER	YEAR	DECILE	TEST	CAT	LOC
SEX	1.00000	-0.03789	-0.03762	0.04875	0.26816	0.19643	0.27260
gender (0 = Male 1 = Female)	0.0	0.5126	0.5155	0.3993	0.0001	0.0015	0.0001
	301	301	301	301	301	258	258
TVER	-0.03789	1.00000	0.95043	-0.08316	-0.16049	-0.13971	-0.03720
test version	0.5126	0.0	0.0001	0.1501	0.0053	0.0248	0.5520
	301	301	301	301	301	258	258
YEAR	-0.03762	0.95043	1.00000	-0.09999	-0.12397	-0.12281	-0.01063
school year	0.5155	0.0001	0.0	0.0833	0.0315	0.0488	0.8651
	301	301	301	301	301	258	258
DECILE	0.04875	-0.08316	-0.09999	1.00000	0.26500	0.04393	0.04778
school decile group	0.3993	0.1501	0.0833	0.0	0.0001	0.4823	0.4448
	301	301	301	301	301	258	258
TEST	0.26816	-0.16049	-0.12397	0.26500	1.00000	0.58644	0.60498
test score	0.0001	0.0053	0.0315	0.0001	0.0	0.0001	0.0001
	301	301	301	301	301	258	258
CAT	0.19643	-0.13971	-0.12281	0.04393	0.58644	1.00000	0.87159
catalogue rating	0.0015	0.0248	0.0488	0.4823	0.0001	0.0	0.0001
	258	258	258	258	258	258	258
LOC	0.27260	-0.03720	-0.01063	0.04778	0.60498	0.87159	1.00000
location rating	0.0001	0.5520	0.8651	0.4448	0.0001	0.0001	0.0
	258	258	258	258	258	258	258

Table 7A: Mean Scores by Test Version

	Primary			Intermediate			Secondary		
	N	Mean	Std Dev	*N*	Mean	Std Dev	*N*	Mean	Std Dev
Test	*94*	19.4	7.7	*120*	16.6	7.2	*87*	16.5	5.8
Catalogue	*65*	21.0	3.3	*120*	18.7	5.4	*73*	19.0	5.5
Location	*65*	23.8	5.1	*120*	22.1	6.7	*73*	23.1	6.5

Significant differences exist between the Primary and Intermediate Tests and the Primary and Secondary Tests. A similar difference exists for the Catalogue Rating.*

Table 7B: Mean Scores by Decile Group

	Decile Low			Decile Middle			Decile High		
	N	Mean	Std Dev	*N*	Mean	Std Dev	*N*	Mean	Std Dev
Test	*47*	15.2	6.8	*177*	16.6	6.9	*77*	20.7	6.8
Catalogue	*47*	19.1	4.6	*163*	19.3	5.4	*48*	19.8	4.3
Location	*47*	22.4	5.7	*163*	22.7	6.6	*48*	23.4	5.8

Significant differences exist between the High and Low Deciles and the High and Middle Deciles for the test only. No significant difference for Catalogue and Location Rating.*

Table 7C: Mean Scores by Gender

	Male			Female		
	N	Mean	Std Dev	*N*	Mean	Std Dev
Test	*147*	15.5	7.3	*154*	19.3	6.4
Catalogue	*125*	18.3	5.4	*133*	20.3	4.5
Location	*125*	21.0	6.7	*133*	24.5	5.4

Significant differences exist between the Males and Females for all three measurements.*

**Tukey HSD test.*

Table 8A: Test Score Manova Summary*

Source	*DF*	*SS Type III*	*Mean Square*	*F Value*	*Pr > F*
Decile	2	969.1	484.5	11.85	0.0001
Gender	1	1124.7	1124.7	27.50	0.0001
Year	3	436.4	145.5	3.56	0.0150
Error	249	10183.0	40.9		
Total	257	12866.4			

**Based on Least Square Means, All other effects not significant*

Table 8B: Catalogue Rating Manova Summary*

Source	*DF*	*SS Type III*	*Mean Square*	*F Value*	*Pr > F*
Gender	1	224.4	224.4	9.41	0.0024
Error	249	5937.1	23.8		
Total	257	6552.0			

**Based on Least Square Means, All other effects not significant*

Table 8C: Location Rating Manova Summary*

Source	*DF*	*SS Type III*	*Mean Square*	*F Value*	*Pr > F*
Gender	1	735.9	735.9	19.99	0.0001
Error	249	9167.5	36.8		
Total	257	10279.8			

**Based on Least Square Means, All other effects not significant*

Table 8D: Overall Effects Significance*

Effect	*Wilks' Lambda*	*F*	*DF*	*Pr > F*
Decile	0.903	4.308	6	0.0003
Year	0.911	2.578	9	0.0064
Gender	0.874	11.773	3	0.0001
Year x Decile	0.894	1.766	15	0.0357

**Based on Least Square Means, All other effects not significant*

Table 9A: Principal Components Analysis

Component	*Proportion*	*Members*	*Weights*	*Meaning*
1	0.369	Test	0.496	Measurement
		Catalogue	0.551	
		Location	0.545	
2	0.277	Test Version	0.661	Age
		School Year	0.664	
3	0.141	Decile Group	0.921	Decile
4	0.127	Gender	0.937	Gender
Cumulative	0.914			

N= 258, 7 Variables (last 3 components ignored due to small size)

Table 9B: Principal Factor Analysis

Factor	*Proportion*	*Members*	*Weights*	*Meaning*
1	0.563	Location	0.909	Measurement
		Catalogue	0.890	& Gender
		Test	0.687	
		Gender	0.307	
2	0.442	Test Version	0.958	Age
		School Year	0.957	

Figure 1: Design Processes: Library Skills Tests

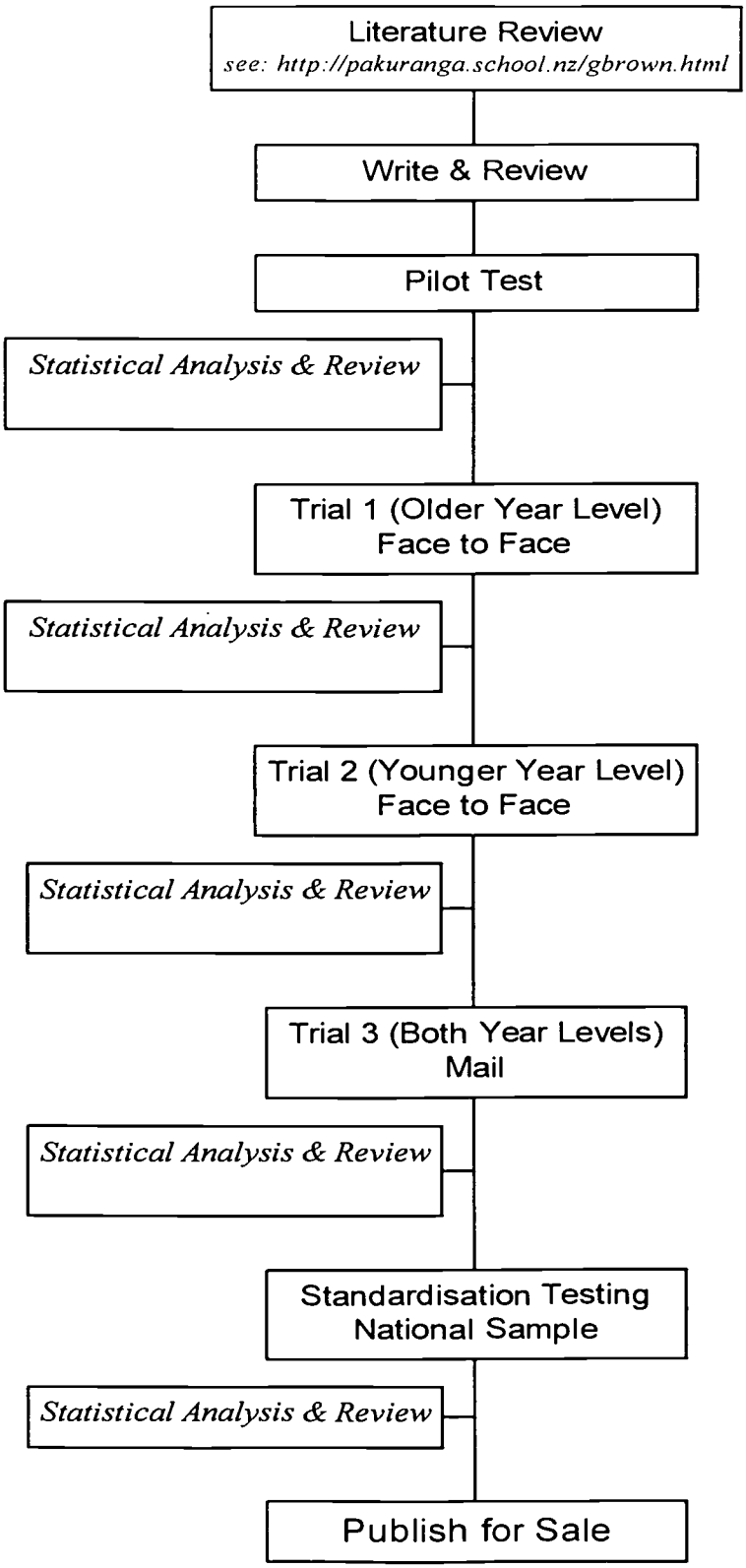


Figure 2: Dewey Decimal Sample Questions

Primary

(13) What does the number 523.2 mean?

- **(A)** There are two books on this topic on the shelf.
- **(B)** There are 523 pages in the book.
- **(C)** There are two books by this writer in the library.
- **(D)** The book is in the 523 section of the library.

[D 83% pb 0.49]

523.2
Asimov, Isaac
Our Solar System
1988
Gareth Stevens Publishing Company : Milwaukee
32p.; ill. (some col.); 26 cm.
Subject: Solar system

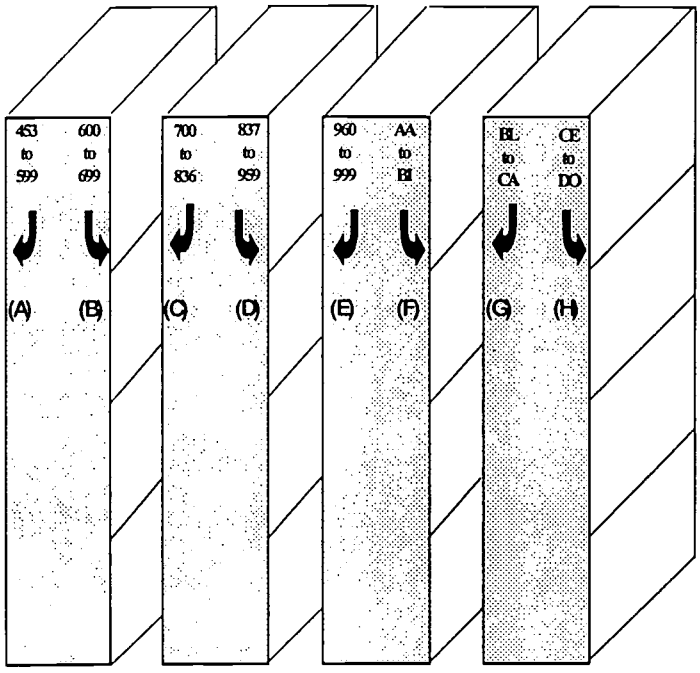
Intermediate

(17) In which bay on which you would find a book with the number 959.9?

[D 70% pb 0.39]

(18) *Air Transport* by Robert Baird at number 600 would be in which bay?

[B 71% pb 0.39]



Secondary

(28) One book on the shelf is in the wrong place.

- **(A)** Write the **full** spine label number of the one book that is in the wrong place.

[303.3 EHI 54% pb 0.62]

- **(B)** Write the letter (A-F) that shows the two books between which the mis-shelved book should go.

[A 33% pb 0.44]

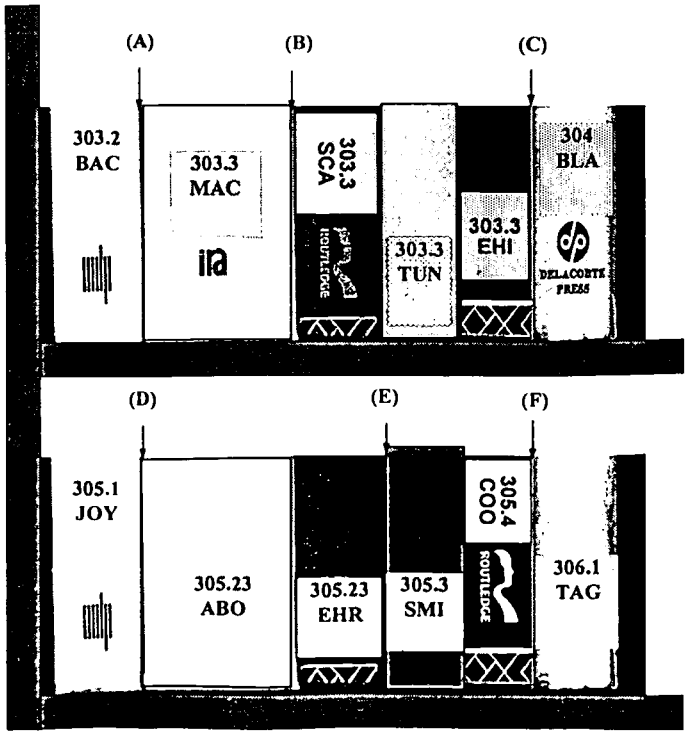


Figure 3: Some Problematic Items - Secondary Test

Below is the search screen of a computer library catalogue. Use it to answer questions 22 to 25. For each question put your answer in the correct field of the catalogue screen. All the answers go in the one screen.

Write in the correct field exactly what you would type in if you were looking for:

(22) books on the topic 'comets – 523.6'.

(23) a book by Carl Sagan.

(24) information about "technology used in space".

(25) the book *The Dragons of Eden.*

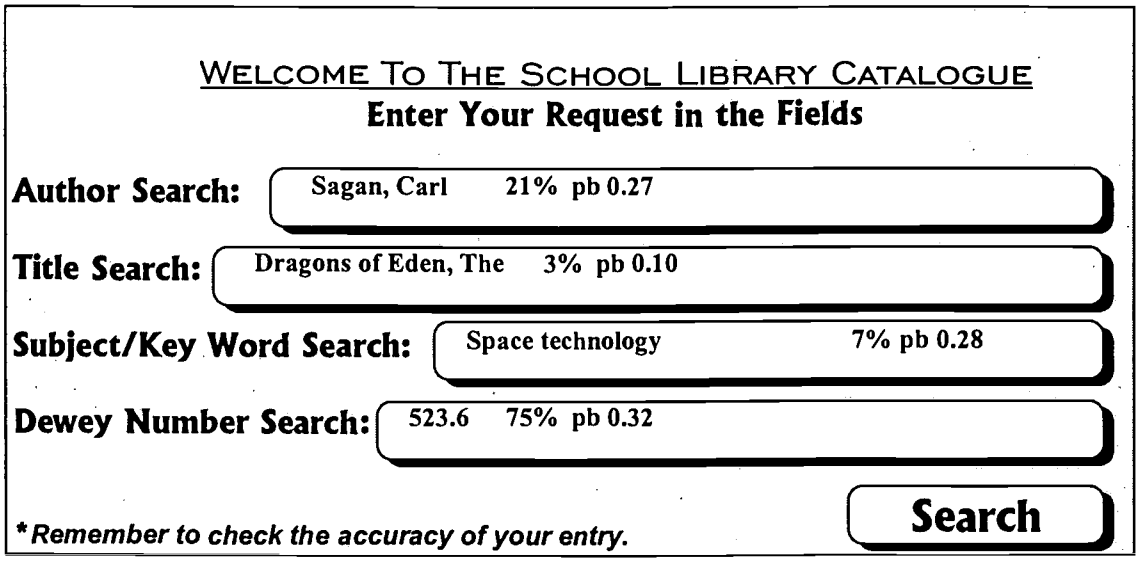
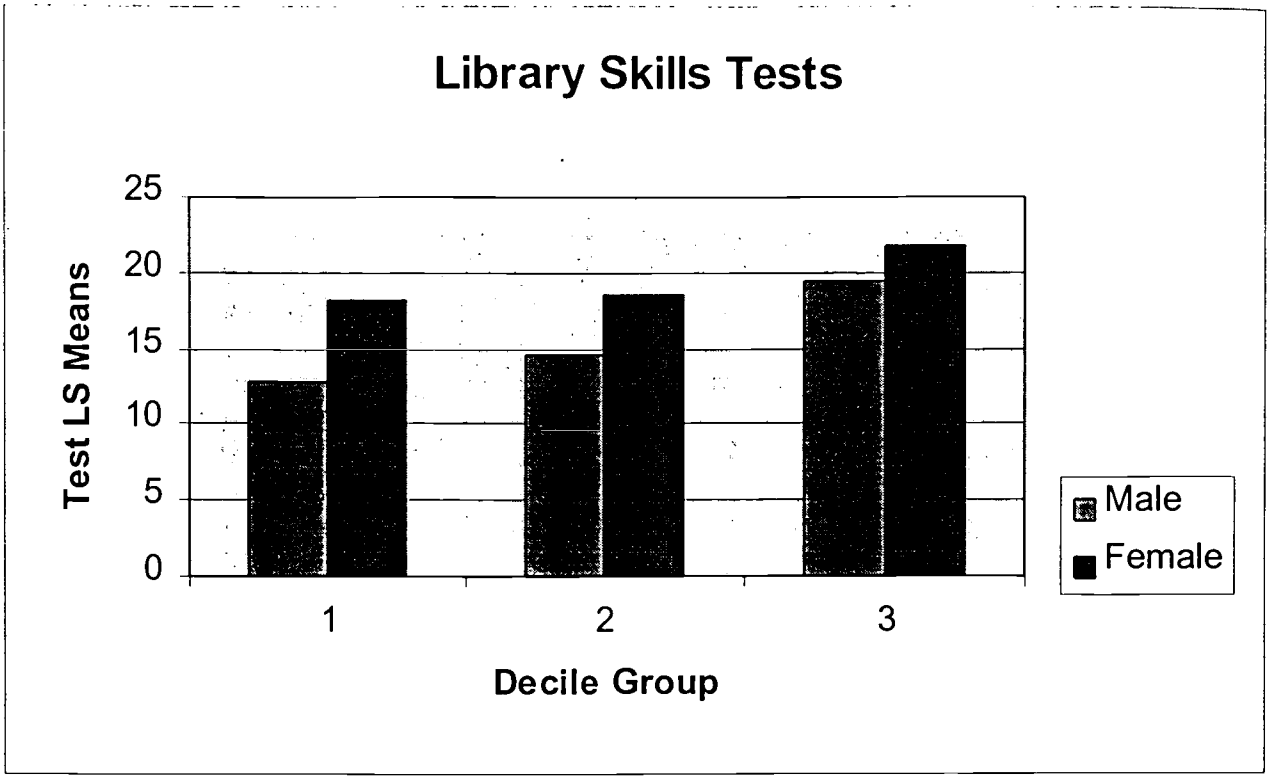


Figure 4: Decile & Gender Results



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