Centralised classification of library materials - a benchmarking study.

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The Occasion

This is a somewhat condensed and edited version of the submission that won the Group's Daphne Clark Prize in 1998

The Authors (and Project Group members)

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Eileen Hiller, Technical Services Librarian, steered the project in Technical Services. She costed the processes and set up the shelf ready acquisition system with suppliers.

Ian Jennings, Senior Cataloguer in the Library, oversaw the various sampling methods - ensuring rigorous data collection methods.

Jennifer Brook, Senior Assistant Librarian for Applied Sciences, was the "human" classifier and subject indexer - providing the benchmark performance.

Heather Moreton, Library Assistant in Technical Services, dealt with and designed the sample collection slips.

Elizabeth Jolly, Media Resources Librarian, was responsible for the fuzzy matching method for analysing subject strings. She now works at South Bank University Library.

Abstract

The Library Management Group of The University Of Huddersfield set up a pilot study to examine alternative procedures for classifying and cataloguing library material in the Health sciences. The study tested the impact of using classification and subject index terms in bibliographic records for titles in the health subject area. The work of the group concentrated on two areas:

* establishing a benchmark for throughput in Technical Services in terms of speed, cost and availability of externally supplied class numbers
* analysis of differences in classification numbers and subject indexing terms between those human assigned and system assigned.

Samples of data were analysed using SPSS software; a fuzzy matching process was undertaken for the subject string analysis.

The results showed considerable savings to be made in terms of both speed and cost. It was instrumental in the decision to change the existing method of acquiring classification numbers. The hit rate for records and the impact on the shelf arrangement were at an acceptable level. The study produced reliable information to provide a benchmark for future developments (for example outsourcing shelf ready books) and performance indicators.

Acknowledgement

Background

A pilot was set up at the University of Huddersfield to examine alternative procedures for the following reasons:

- The harmonisation of library routines was necessary because of the merger of the former West Yorkshire College of Health with the University. In April 1996 the Library inherited three small and dispersed health site libraries with some 25000 vols. requiring cataloguing to AACR2 - level 1-2, to Dewey Decimal Classification (initially edition 20 and eventually edition 21) and to Library of Congress subject headings. This was identified as a strategic development in mid 1996.

- A reorganisation of library staff had left the Health subject team with no librarian able to undertake the classification of newly acquired titles in the traditional manner and a backlog had arisen. The traditional process for new titles involved classification and subject indexing by a subject librarian away from Technical Services.

- New developments in technology in the acquisitions area needed to be exploited for example EDI (Electronic Data Interchange), and shelf ready supply systems.

When the study began 80 per cent of catalogue records were bought in and 14 per cent produced in house.

Aims of the project

The project had distinct aims:-

- to clear the backlog of titles (600 volumes)
- to integrate the health site collections in terms of circulation control and catalogue access.
- to measure existing speed of throughput for new titles - to establish a benchmark against which processes and resource could be measured.
- to examine the use of SLS records as an alternative to 'human' terms
- to evaluate the impact on existing shelf arrangement - using scatter analysis.
- to evaluate the impact on existing subject headings

- to exploit new methods of working in an IT rich, progressive environment.
- to work collaboratively with colleagues from other sections of the Library.
- to report back to the Library Management Group within six months.

Planning & objectives

Success criteria were established so that the project outcomes could be evaluated. These were defined as - the extent to which the aims were met; the completion of the project on time; the production of reliable information - that is, results based on fact rather than surmise; increased collaboration across the Library.

Stakeholder analysis took place to identify the interested parties so that the project could proceed with the necessary input from a range of library staff. This stage was crucial; the pilot met with some opposition in the initial stages. Potential changes of roles and job functions were threatening to many staff. Regular briefing sessions and reports in the Library bulletin were helpful to both the project group and other staff.

Methodology

A literature search revealed little. The Group found no published studies of a similar nature. Most of the literature compared two different classification systems or concentrated on detailed Technical Services processes - for example, cataloguing processes using a variety of systems. This meant that methodology had to be designed from scratch.

Survey Design began with establishing the range of information required. The chart below shows this process and also the required indicators. In turn the Group was then able to decide on the method of data collection and the measurement processes.

Table 1: *Data Collection - identification of Information required/indicator assigned. What do we want to find out from the pilot?*

Information	Purpose	Indicator	Data Collection
Impact on shelf (Scatter)	Consistency variation Cross-Site DDC21	Comparison of class nos. (new/existing)	Class numbers assigned (where different)
Speed	Time taken to add books to stock.	Analysis of all processes	Tracking titles by date and section
Resources used	Identify costs and possible savings/ benefits	Costing: staff time and materials	Grade of staff-Time taken
Impact on subject headings	Consistency Variation	Comparison of subject strings	Subject strings (where different)
Proportion of original classification	Identify resources	Establish hit rates Speed Staff input	Number of items needing DDC

It was decided to use coloured slips inserted in books as they passed through the various stages of acquisitions and cataloguing. Dates and times were recorded. This method would also aid Technical Services by allowing measurement of the various tasks and processes.

Rigour, reliability and validity were important factors. A lot of time was spent on the slip design. The slips were piloted first to make sure they "worked" and the relevant staff were trained to complete the slips correctly. This was monitored throughout the project.

The project group met every two weeks to record progress and minutes were essential to focus the work.

Data Collection

Benchmarking. The purpose of the benchmarking exercise was to measure throughput and cost of two different processes in Technical Services - one the conventional process and the other a new process. The current system for making books shelf ready (from date of receipt in acquisitions) involved using class numbers and subject headings assigned by subject librarians. For the purposes of the project this included books from five schools (Applied Sciences, Business, Computing, Maths & Engineering, Design Technology, Humanities) as well as books from a General fund and the Teaching and Learning Collection.

The second process was the new one that used class numbers and subject index terms supplied in bibliographic records. To measure this from the bibliographic record searching stage to the shelf ready stage a sample was taken from Human and Health Sciences titles.

Three samples were taken - identified by different coloured slips inserted in the books. The first two samples measured the conventional process and the third sample the new process.

Mainstream sample (White slips)

The purpose of the sample was to provide a benchmark of time taken against which the new practice could be measured. Procedure was as follows:

White slips were placed in every newly receipted book. Within this, the survey random samples (40 titles from each School, etc.) were 'hidden' and identified by a marking known only to a few Technical Services staff. These titles were selected (every twentieth record) by Acquisitions staff until

the benchmark was complete. The masking of the random samples was felt to be necessary to ensure these titles passed through Technical Services with no deviation from usual practice.

Dates for each process in these titles throughput were recorded on all white slips. The stages were: Date of receipt/sent to cataloguing; Date of SLS search/sent for classification; date returned to cataloguing; date of item record was creation; date when the item spined; checking; date that item was ready for the shelf. At the end of the cataloguing process the sample slips were identified and separated out.

Librarian Classified sample (Yellow slips)

The purpose of the classified sample was to:

Calculate the average time taken to classify.

Calculate the staff cost of the classification/indexing process.

Compare the class numbers assigned by a subject librarian using DDC 20 against those supplied on the SLS records

Compare the Library of Congress subject headings assigned by the subject librarian against those supplied by SLS.

Ascertain the percentage of records without supplied class numbers and LC subject headings.

Ascertain the percentage of records with supplied DDC 21 class numbers.

The projected number for the classified sample was 200, but only 119 were collected. This was because of the number of duplicates found in the Health backlog, caused by the progression of a Healthcare Sites retrospective cataloguing project, which overlapped. In trying to complete the classified sample in the time scale of the project the subject librarian found it difficult to set aside time for the considerable increase in her workload. The Project Group felt it was necessary for consistency and objectivity to have this work done by one person.

Procedure was as follows:

Slips were placed in the backlog of Human and Health titles awaiting classification, subject indexing and cataloguing.

Over the period of the pilot (approximately six

months) the subject Librarian collected batches of these titles for original classification and subject indexing using DDC 20 and Library of Congress Subject Headings.

The times of the beginning and end of each of these processes were recorded on the slips as well as the assigned class numbers and subject headings. For the purposes of the project class numbers and subject headings assigned in this fashion were dubbed *'human assigned'*. Once this was completed the books were returned to Technical Services and the date recorded.

When the yellow slip books were passed to Cataloguing, process times continued to be recorded. Also recorded were any class numbers and subject headings supplied in the bibliographic record. As a means to distinguish them, these supplied numbers and headings were dubbed *'machine assigned'* even though they would actually have been assigned by people working for whatever agency had supplied the record.

A further note was made of the Dewey edition that supplied class numbers had been drawn from. The main intention of the 'yellow' sample was to compare ' human' and 'machine' numbers and headings in order to anticipate unacceptable deviations from local practice if these were to be uncritically accepted as supplied. Dewey editions were recorded in order to anticipate the effect of using DDC21 numbers in a library still largely based on DDC20.

Machine classified sample (Grey slips)

The purpose of this sample was to:

record and measure time savings if supplied class numbers and subject headings were uncritically accepted, without recourse to classification by a Subject Librarian.

identify the time taken for the item record creation process.

The procedure was as follows:

200 of these slips were placed in titles in the backlog. The sample was processed by Cataloguing staff in batches. Start and finish times for each process were recorded (as above) .

In addition, titles without supplied class numbers or subject terms were returned to the backlog. Since they could not serve the main purpose of this sample, they were replaced by other titles. However they were used to calculate the percentage hit rate for the project.

Sampling problems

The first problem was in finding enough material to satisfy the random nature of the mainstream sample within the time scale of the project. This has resulted in a slightly uneven base to be used for measurements and Applied Sciences were not as well represented as other schools. Another problem was that although it was convenient to use the Health backlog for the classified (yellow slip) and unclassified (grey slip) sample, it would not have been accurate to measure throughput from the order stage for these titles, as there was an obvious time lapse between their receipt and the bibliographic search stage.

From the machine classified sample, some titles without supplied class numbers or subject terms were returned to the backlog. This created temporary problems in making sufficient backlog titles available for the 'grey' sample.

The bibliographical record obtained from the SLS database used Library of Congress subject terms. Some of these are not applicable in the UK. Consequently the time factor for subject indexing was much increased because of the need to search for more relevant terms.

Some problems were encountered with inaccurate keyboarding of data using the SPSS package. The case numbers were identified at a quality control stage when the results were examined and rectified.

Data input and analysis

The Group decided to approach the University's Computing Services for help in devising and implementing a structured method to input and compile the data from the slips and to output it according to the criteria the project wished to demonstrate. The Computing Services School Support Officer suggested the SPSS spreadsheet package as suitable. The Group was to outline the nature of the data and what was required from it so

that he could set up appropriate SPSS files.

Library staff who had volunteered to input the data were given training by the CSSSO. Each slip was given a unique case number so it could later be identified if any problems arose with the data output and analysis. Each of the samples was allocated a range of case numbers, which were clearly designated. Checks were done when the results were first analysed to assure the integrity of the data: incorrectly entered data, identified by its case number, was re-entered.

In order to 'sort' the sample slip data into useful categories, the CSSSO required precise instructions as to the data entry categories to be set up on SPSS as well as the combinations of these categories which would provide data output.

These were written up in a *Required measurements* document (see the format of Appendix 1). These instructions asked for average calculations, both for the total time taken for the whole process involved in each sample, as well as for the separate processes within each. Of particular interest to the Group were the times between certain processes where elapsed time was much longer than the time for the process itself.

Graphical analysis   The SPSS package is also able to convert data into graphical output. Two graphs were requested by the Group:

1. Median scatter graph - an x-y axes plot of class numbers for each of the 'yellow' sample cases. This would demonstrate the scatter caused by differences between 'human' and 'machine' assigned class numbers.

2. 'High-low' graph. This graph was intended to show more clearly the shelving 'distance' between differing human and machine class numbers. The two numbers for each case would be plotted. Where class numbers agreed they would be superimposed one on the other.

Results

Throughput

[A summary of the most important results, in tabular form, will be found in Appendix 1.]

The results of the measurement of the total throughput show, on average, a saving of ten days using the new process.

The classification and subject indexing process using a subject librarian took on average 9.99 days including collecting and returning items to the Technical Services Workroom. The time for classifying averaged 2.87 minutes, and for subject indexing 4.25 minutes, giving a total of 7.15 minutes. Subject indexing adds considerably to the time taken for the whole process

The time taken before item records were created, using either process, were close enough to take 4.5 days as the norm.

Implicit in these calculations is that downloading of class numbers and subject index terms from bibliographical records to item records actually takes seconds - so that aspect of the process was not measured. However, it should be noted it is likely this process would take longer if a table of criteria involving translation of certain numbers had to be applied.

The time taken before items were spined was similar in both processes averaging 0.4 days. Again the time taken from spining to the quality control stage, was similar averaging 2.85 days. The time taken from completion of quality control to books on the shelves averaged 0.28 days.

The saving in time in accepting data from bibliographic records can speed up the process by some 10 days, with differences a minimum 4 days and maximum 12 days.

The hit rate for successful searching and downloading of bibliographical records for this project was 85.78%. This compares with a hit rate for the year for all subject areas of 86.27%.

Scatter (Class number) analysis

Class numbers assigned by the subject librarian were compared with those supplied on the SLS records.

Of the 119 records 86 had class numbers supplied, 33 were without. The percentages for supplied and non-supplied were therefore 72% and 28%.

Of the 86 records that had class numbers supplied by SLS, 35 i.e. 40.7% matched exactly those supplied by the subject librarians. 8 of the class numbers supplied had the same basic class number assigned by the subject librarian but with the addition of the geographic subdivisions from Table 2 in DDC. For the purpose of this pilot it was considered acceptable to include these as a near match. 3 of the supplied class numbers used standard subdivision additions from Table 1 of DDC not assigned by the subject librarian - which were treated as near matches.

5 records had DDC 21 class numbers supplied - 5.8% - and these records were not also supplied with DDC 20 records.

The remaining records had differences in classification which are important to note:-

8 records were assigned class marks in different disciplines, e.g. 362.61 v 610.736

7 records had class marks within the same discipline but in different subdivisions, e.g. 362.1068 v 370.78

4 records were within different subdivisions, e.g. 361.3 v 362.8282809

Analysis of subject strings (index terms)

This analysis was more complex as the group had not been able to ascertain any previous methodology. The method arrived at was as follows:-

The number of records without SLS supplied subject terms was recorded.

From the 119 classified sample (yellow slips), 50 records were chosen at random. The subject index terms assigned by the librarian (human terms) were then compared against the SLS supplied terms (machine terms).

For each record the number of 'terms' were counted. A 'term' is equal to an individual descriptor as provided by LC which could comprise one or more words, e.g. 1. Aged *plus* 2. Aged-Abuse of counts as two terms.

The total number of 'words' (omitting a, the, and, of, etc.) were counted across both the 'human' and 'machine' terms. Duplicated words were included in the count. The number of words matching in both the 'human' assigned and 'machine' assigned terms were totalled - counting words duplicated, e.g.

Human assigned: Aged
                   Aged-Abuse of
                   Aged-Abuse of-Investigation
Machine assigned: Aged
                   Aged-Abuse of

Total number of matching words = 8. Remaining unmatched words were counted and recorded as 'missing words; in this example there is one unmatched word - Investigation

These missing words were then compared against the words in the title, since title keyword is often used to supplement subject searches by users. Any matches were recorded as 'missing words in the title'.

The total number of missing words is the figure arrived at when the number of 'missing words in the title' is subtracted from the number of 'missing words'.

21% of the 119 records did not have SLS (machine) supplied subject index terms.

59% of the total number of the words from the subject index terms supplied by the subject librarian matched those in the SLS records.

32% of the 50 records had an equal number of supplied terms e.g. 2 terms were assigned by the subject librarian and 2 on the SLS record.

34% had less terms supplied by SLS and 34% had more terms supplied by SLS.

Of the words that were missing (41.4% of the total words) only 13.3% of these were matched in the title. The final figure of missing words therefore was 35.8%.

Resources

One of the project's fundamental requirements was a comparison of the average staffing costs involved in manually classifying and subject indexing books

and the average costs of accepting supplied class numbers. An hourly rate of pay for each level of staff involved in classification and cataloguing was used. [£ 8.60 for Senior Assistant Librarian (Scale 6), £ 6.07 for Senior Library Assistant (Scale 2/3) and £ 5.28 for Library Assistant (Scale 1/2)] This was multiplied by the average times for relevant processes in the 'grey' and 'yellow' samples. In the same manner an overall cost for clerical processes was determined.

The conventional process used Senior Assistant Librarian (Scale 6) staff time for the intellectual part of the process, the classification and subject indexing.

Both processes used Library Assistant (Scale 1/2) staff time for creation of item records and for spining and Senior Library Assistant (Scale 2/3) staff time for quality control.

Staff time is the resource measured as part of this project. The project assumes the overheads in terms of plant, materials, hardware and software used, are the same for both the conventional and the new process.

Comparison of costs per item were:

Using the conventional process including classification and indexing by Scale 6, the costs are: **£2.45 per title**. Using the new process the costs are: **£1.425 per title**. This represents a saving of **£1.03** on each new title going through the system.

Of course duplicate items will cost the same as the cost of the new process, as no classification or subject indexing is involved

Validation.

The costs of validation could increase the costs of the new process. Validation was not considered by this pilot project but the Group recommended this be reviewed by a Library Group set up to continue the work - to be called the Classification Implementation Group. It has subsequently been shown that this issue is not significant as the time taken is negligible.

Recommendations

The Project Group made the following recommendations to the Library Management Group - which highlighted areas requiring further work.

- The acquisition process should be benchmarked from the earliest stages, that is, from the order being created by the subject teams, to its receipt in cataloguing. This should be possible using *Reportsmith* - the Horizon management software. It may also be desirable to widen this measurement to include waiting times of requested material under consideration in subject teams

- The impact on shelf arrangement of adopting DDC 21 numbers should be investigated; the Classification Implementation Group has begun this process. It is acknowledged that additional resources may be required for retrospective conversion - this should not stifle attempts to migrate to the centralised system.

- The Library Of Congress subject headings scheme should be assessed for utility and integrity: guidelines for improving uniformity and control should be established.

- The validation of classification numbers and subject headings should be addressed. Robust methods should be devised and monitored.

Conclusions

Some material will still require original classification (27%) and subject indexing (21%) by · subject teams. The results show that there are considerable savings to be made, in terms of staff time and costs, by adopting a central system for classification and subject indexing using bibliographical records. This benefit can be equated in monetary terms and in librarians' time freed up to carry out other duties. However, this must be offset by any additional costs incurred.

The benchmarking process was important in enabling evaluation by Technical Services of throughput speed using reliable information. This must be measured again at a later date when new systems have been in place for some time in order to re-evaluate, refine and improve performance and assist with quality control. It could be extended to measure the total time a book order takes from the order stage to the shelf.

The scatter analysis shows an acceptable number of similar numbers with most cases clustered round the median. This is, however, a subjective assessment and variations may be wider in other subject areas. Also, there were insufficient records with DDC 21 numbers for any conclusions to be drawn regarding the impact that this would have on shelf arrangement in the Health area. These issues will be taken up on a library wide basis by the Classification Implementation Group.

In line with current Library strategy to foster student independence and competent retrieval skills, and with the growing trend of students studying interdisciplinary modules across subject disciplines, subject indexing assumes increasing importance as users rely less on the expertise of Library staff.

The analysis in this project is not foolproof and cannot deal with all complexities of language and vocabulary. However the number of matches between human and machine assigned terms is encouraging enough to suppose that the majority of users would be able to trace their materials - for example by using both title keyword and subject keyword searches on the Library catalogue. It is more questionable whether the Library of Congress system itself is appropriate for our needs.

Finally, this pilot study was successful in that it achieved its stated success criteria: (1) getting rid of the Human and Health Sciences backlog; (2) supplying reliable information about the effects of implementing a method of assigning class numbers and subject index headings which utilises minimum intellectual effort; and (3) providing a foundation for future development, based on fact rather than surmise. This will be useful, for example, in making decisions on the use of shelf ready systems.

This report is informing the Classification Implementation Group in taking the project further beyond the pilot stage into a scaleable solution for adding items to the Library's stock. The results of the pilot should form the basis for a systematic evaluation of shelf ready supply systems, and also contribute to internal methods of review so that we continue to improve our services to users by measuring our performance.

Appendix 1 - Selection of Measurements

White slips   MAINSTREAM SAMPLE

1. SLS search Item available on shelf (days).
    Measures average time for whole current cataloguing process. 18.0 days

2. SLS search Returned to cataloguing (days).
    Average time titles are effectively away from Technical Services
    for classification and subject indexing process. 10.0 days

3. Returned to cataloguing Item(s) created (days).
    Average time before returned titles have items created. 4.5 days

4. Item(s) created Item spined (days).
    Average time before items are spined, including time spent on spining. 0.4 days

5. Item spined Checking (days).
    Average time items wait for checking. 2.85 days

6. Checking Item available on shelf (days).
    Average time for checking. 0.28 days

Grey slips. MACHINE CLASSIFIED SAMPLE

1. SLS search start time Item available on shelf finish time (days).
    Average time for whole 'machine classified' cataloguing process using
    supplied class numbers. 8.0 days

2. Bib search start time Item create finish time (days).
    Average time for item creation. 4.5 days

3. Item create finish time Item spined finish time (days).
    Average time for item spining, including time awaiting spining. 0.4 days

4. Item spined finish time Checking start time (days).
    Average time items await checking. 2.85 days

5. Checking start time Item available on shelf (days).
    Average time for checking. 0.28 days

6. Percentage of sample with supplied class numbers: Number of slips
    indicating supplied class number as percentage of the total size of whole
    sample (From No class no. box).
    Supplied class number hit rate. 72 %

7. Percentage of sample with supplied subject index terms: Number of slips
    indicating supplied subject index terms as percentage of the total size of
    whole sample (From No SI box).
    Supplied SI terms hit rate. 79 %

Yellow slips. LIBRARIAN CLASSIFIED SAMPLE

1. Collected from Technical Services start time Returned to cataloguing
    finish time (days).
    Measures actual time spent on classification and subject indexing process.   10.0 days

2. Classification start time Classification finish time (minutes).
    Average time for Subject Librarian to classify.   2.87 mins

3. Subject indexing start time Subject indexing finish time (minutes).
    Average time for Subject Librarian to subject index.   4.25 mins

4. Sum of average classification and subject indexing times (minutes).
    Average time for classification and subject indexing.   7.12 mins