



From Sears to MeSH: A Comparative Analytical Study of Controlled Vocabulary, Subject Access, and Knowledge Organization with Special Reference to Dr. M. P. Satija's Contributions to Subject Heading Theory

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Abstract

This study compares three influential controlled-vocabulary systems—Sears List of Subject Headings, Library of Congress Subject Headings (LCSH), and Medical Subject Headings (MeSH)—through a comparative analytical framework centred on subject access, semantic relationships, specificity, hierarchy, syndetic structure, and knowledge organization. A coded secondary dataset of 90 heading records was constructed, comprising 30 legally traceable public Sears headings, 30 LCSH headings, and 30 MeSH descriptors. Each entry was coded for scope-note availability, broader-term, narrower-term and related-term relationships, entry-term richness, hierarchy level, coordination tendency, specificity, user-access support, and cross-reference richness. Descriptive statistics, chi-square testing, Kruskal–Wallis comparison, and Spearman correlation were used to interpret cross-system differences. The results show a graded movement from Sears as a compact, user-facing general subject-heading list, to LCSH as a large-scale national authority vocabulary with strong pre-coordination, and to MeSH as a domain thesaurus optimized for biomedical indexing, hierarchical explosion,



and post-coordinate retrieval. Scope-note availability differed significantly by system, and specificity scores also varied significantly across the three vocabularies. Synonym and entry-term richness showed a strong positive association with coded user-access support. The discussion locates these empirical findings within Dr. M. P. Satija's contributions to subject heading theory, especially his emphasis on aboutness, specificity, terminological control, classification discipline, and local adaptation. The study concludes that controlled vocabularies remain essential in digital discovery environments, provided that their authority structures are made transparent, inclusive, machine-actionable, and responsive to domain-specific retrieval needs.

Keywords: controlled vocabulary; subject headings; Sears List of Subject Headings; LCSH; MeSH; knowledge organization; M. P. Satija

1. Introduction

Controlled vocabulary is one of the central technologies of bibliographic control. It gives documentary languages a disciplined vocabulary through which the same subject can be represented consistently even when authors, cataloguers, indexers, and users employ different words. In libraries and information systems, this function has historically been performed by subject-heading lists, thesauri, classification schemes, authority files, and, more recently, linked-data vocabularies. The problem is not merely terminological. It concerns the intellectual act of deciding what a document is about, selecting a preferred access point, establishing equivalence between synonyms, and placing the concept within a network of broader, narrower, and related ideas. The Sears List of Subject Headings, LCSH, and MeSH represent three distinctive answers to this problem.

The three vocabularies selected for this study differ in institutional scale, audience, domain, and semantic ambition. Sears is designed for small and medium-sized libraries and emphasizes concise, popular, uninverted terminology and local adaptability (Grey House Publishing, n.d.-a, n.d.-b). LCSH is a large national and international authority vocabulary, actively maintained by the Library of Congress since 1898 and used by libraries in the United States and internationally (Library of Congress, n.d.-a). MeSH, produced by the National Library of Medicine, is a hierarchically organized biomedical thesaurus used for indexing PubMed, NLM databases, and biomedical literature (National Library of Medicine, 2025a). A comparison across these systems therefore helps to clarify how general library subject access, national authority control, and domain-specific thesaurus design organize knowledge differently.

The study also places this comparison in relation to Dr. M. P. Satija's contribution to subject heading theory and knowledge organization. Satija's work is significant because it brings together subject cataloguing, classification theory, the Sears tradition, Dewey Decimal Classification, Colon Classification, and the logic of facet analysis. His role is not treated here as a biographical add-on but as a theoretical lens: subject headings require a disciplined understanding of aboutness, preferred terms, cross-reference construction, specificity, syntactic consistency, and pragmatic adaptation to local collections. This perspective is particularly useful in evaluating vocabularies that differ in audience and structural depth.

The paper responds to a practical research gap. Many discussions of controlled vocabulary describe each system independently, but fewer studies combine entry-level coding, statistical comparison, and theoretical interpretation across general subject-heading lists and a domain thesaurus. The present paper therefore constructs a 90-entry coded dataset and applies statistical analysis to compare Sears, LCSH, and MeSH. The resulting findings should be read as a transparent content-analysis study rather than as an official audit of any vocabulary authority file.



2. Background: Controlled Vocabulary and Subject Access

Controlled vocabulary operates through three basic mechanisms: preferred terms, equivalence control, and semantic relationship control. Preferred terms reduce variant naming by requiring cataloguers and indexers to select an authorized heading. Equivalence control handles synonyms, spelling variants, inversions, near-synonyms, and deprecated expressions. Semantic relationship control connects a heading to broader, narrower, and related concepts. These mechanisms produce syndetic structure: the network of references that tells users and systems how concepts are connected. In traditional catalogues this structure supports browsing; in modern discovery layers and linked-data services it also supports machine-readable navigation.

A subject-heading list and a thesaurus overlap but are not identical. The Sears principles explain that a subject-heading list may include pre-coordinated strings made from topical headings and subdivisions, whereas a true thesaurus displays hierarchical and associative relationships among discrete descriptors more systematically (Grey House Publishing, n.d.-b). This distinction is crucial for comparing Sears and LCSH with MeSH. Sears and LCSH retain a strong subject-heading-list character, although both use cross-references. MeSH, by contrast, is explicitly organized as a biomedical thesaurus with tree structures, descriptors, entry terms, and retrieval functions such as explosion (National Library of Medicine, 2025a, 2025b).

Subject access is not only a matter of recall. It also concerns precision, user language, inclusiveness, and transparency. Recent work on MeSH demonstrates that controlled terms can still improve systematic-review searching, although MeSH-only searching is not a complete substitute for free-text strategies (DeMars & Perruso, 2022; Leblanc et al., 2024). Recent work on inclusive description also shows that subject headings are socially consequential because authorized terms may either improve access for communities or reproduce outdated and exclusionary language (Wintermute et al., 2024). The comparison undertaken here therefore evaluates semantic structure and social intelligibility together.

3. Sears List of Subject Headings

Sears List of Subject Headings is historically associated with practical subject access for small and medium-sized libraries. Its public principles describe it as a subject authority that supplies authorized terms and cross-reference suggestions while serving as a skeleton or pattern for local authority development (Grey House Publishing, n.d.-b). This makes Sears different from a comprehensive national authority file. It is intentionally selective, economical, and oriented toward the likely needs of a typical smaller collection. Its design philosophy privileges popular terminology, direct entry, and local expansion.

The Sears principle of specific and direct entry is especially relevant to Satija's theoretical concerns. The public Sears principles state that a work should be entered under the most specific heading that accurately represents its subject, not under a broader class merely because the broader class contains the topic (Grey House Publishing, n.d.-b). This aligns subject cataloguing with the analytical task of determining aboutness. The heading should be co-extensive with the work's subject; it should not be broader than necessary or narrower than justified by the document itself.

The current public Sears front matter also shows how the vocabulary responds to social and technological change. Recent additions and revisions include terms related to racial equality, social change, digital finance, and the COVID-19 pandemic, including Black Lives Matter movement, Nonbinary people, Crowdfunding, Cryptocurrencies, COVID-19, and Masks (Grey House Publishing, n.d.-a). The publicly visible list of canceled and replaced headings similarly documents changes toward more current and inclusive



terminology, such as the replacement of older terms by Black people, Intellectual disabilities, Undocumented immigrants, and Female genital mutilation (Grey House Publishing, n.d.-c).

A methodological limitation must be stated at this point. Complete current Sears entry-level data are not fully open for unrestricted harvesting. The public site exposes front matter, key headings, subdivisions, and replaced-heading lists, while full searching requires access to the online database. Therefore, the Sears sample in this paper is limited to legally visible headings and public documentation. Counts that require complete entry-level authority data are treated conservatively and interpreted as coded evidence from the public sample rather than as comprehensive Sears database metrics.

4. Library of Congress Subject Headings

LCSH represents a different scale of subject authority. The LC Linked Data Service describes LCSH as an actively maintained vocabulary since 1898 for cataloguing materials at the Library of Congress, with extensive use by cooperative cataloguing libraries in the United States and internationally (Library of Congress, n.d.-a). The linked-data service includes subject headings, free-floating subdivisions, genre/form headings, children's headings, and validation strings created for machine validation of subject strings. This makes LCSH not only a human cataloguing tool but also a large, machine-distributable authority infrastructure.

The system is strongly associated with pre-coordination. Subject strings may combine topical terms with geographic, chronological, form, or topical subdivisions, producing complex access points such as headings for literature, place, history, and specialized forms. This gives LCSH expressive power but also creates interpretive complexity. Users may not always know the authorized order of terms or the subdivision pattern, and cataloguers require extensive manuals and authority-control training. The system is therefore powerful but institutionally demanding.

In linked-data form, LCSH has gained new relevance for digital knowledge organization. Uniform resource identifiers, alternate RDF/SKOS serializations, and public authority records allow the vocabulary to function beyond the card catalogue and the OPAC. At the same time, LCSH has been criticized for unevenness, historical inertia, and problematic terminology in areas involving identity, race, migration, gender, and religion. Recent inclusive-description literature treats subject-heading revision and supplementary headings as a practical strategy for improving equity in discovery systems (Wintermute et al., 2024).

5. Medical Subject Headings

MeSH is a domain-specific biomedical thesaurus. NLM describes it as a hierarchically organized terminology for indexing and cataloguing biomedical information and for indexing PubMed and other NLM databases (National Library of Medicine, 2025a). It differs from Sears and LCSH because its primary environment is specialized biomedical retrieval rather than general catalogue browsing. Descriptors are placed in tree structures, entry terms support equivalence control, and qualifiers permit post-coordinate refinement.

MeSH has a strong retrieval function. In online searching, the tree structure allows searchers to use a descriptor broadly or to explode it in order to include narrower descriptors (National Library of Medicine, 2025b). Entry terms and other cross-references function as synonyms, near-synonyms, alternate forms, and closely related expressions that guide users toward the preferred descriptor (National Library of Medicine, 2025c). This makes MeSH particularly rich in equivalence control and hierarchical browsing.



Recent empirical work reinforces the continuing value of MeSH in biomedical retrieval. DeMars and Perruso (2022) compared MeSH and text-word searching for library instruction and showed that the two strategies have different implications for precision and recall. Leblanc et al. (2024) found that removing MeSH terms from systematic-review search queries decreased sensitivity while slightly increasing positive predictive value; the authors concluded that MeSH remains indispensable for systematic reviews even though it increases screening workload. Other recent research has examined the impact of automated indexing on MeSH assignment, indicating that controlled vocabulary is also affected by automation and algorithmic decisions (Fernández-Llimós et al., 2024).

6. Dr. M. P. Satija's Contributions to Subject Heading Theory

Dr. M. P. Satija occupies a prominent place in Indian and international Library and Information Science through his work on classification, subject cataloguing, DDC, Colon Classification, and the Sears tradition. Public professional profiles describe him as a UGC Emeritus Fellow in Library and Information Science, a prolific author of books and peer-reviewed papers, and a scholar whose works have circulated internationally (INFLIBNET Centre, n.d.). The ALA Store profile similarly notes his extensive writing on library classification systems, especially Dewey Decimal Classification and Colon Classification, and his association with international knowledge-organization work (American Library Association, n.d.).

For this paper, Satija's relevance lies in the connection he makes between classification discipline and subject-heading practice. Subject headings often appear to be simple verbal labels, but their construction depends on the same intellectual operations that underlie classification: isolating the subject, determining citation order where needed, distinguishing broader and narrower concepts, and balancing specificity with usability. Satija's work on Sears, including his introduction to the 22nd edition, emphasizes vocabulary control, subject access, new headings, and the practical significance of a list intended for small and medium-sized libraries (Satija, 2018).

Satija's theoretical contribution may be summarized in four linked propositions. First, subject cataloguing begins with aboutness rather than with mechanical term matching. Second, preferred headings require consistency, but not rigidity that ignores user language. Third, classification and subject headings are complementary tools: classification arranges documents in a systematic order, while subject headings multiply verbal access points. Fourth, local cataloguers remain intellectually responsible for adaptation, especially when a compact list such as Sears is used as a pattern rather than as a complete database. These propositions are useful for interpreting the present results because they prevent a simplistic ranking of one vocabulary as universally superior. Each system embodies a different institutional and epistemic compromise.

7. Review of Literature

Recent literature on controlled vocabulary emphasizes both technical structure and social accountability. Mandal (2022) presents controlled vocabulary and thesaurus construction as practical components of digital information retrieval, highlighting relationships among terms, visual vocabulary, and user-oriented access in digital-library environments. This supports the view that controlled vocabulary is not obsolete in the web era; instead, it must be designed and displayed in ways that make relationships visible to users.

Studies in biomedical retrieval provide an empirical basis for the continuing value of controlled indexing. DeMars and Perruso (2022) show that MeSH and text-word search strategies differ in recall and precision, a finding directly relevant to information-literacy teaching. Leblanc et al. (2024) extend the question to



systematic reviews and demonstrate that the removal of MeSH terms affects sensitivity, positive predictive value, and screening burden. These studies suggest that controlled vocabulary contributes to retrieval quality even when keyword searching is readily available.

Recent work on metadata ethics and inclusive description shifts attention from structural performance to the social consequences of authorized language. Wintermute et al. (2024) discuss subject headings as part of diverse, equitable, and inclusive description, with practical attention to LCSH revision and alternative headings. This literature is important because the authority of a vocabulary does not guarantee its neutrality. Controlled terms can improve access, but they can also preserve outdated classifications of communities if they are not revised.

The Sears literature is thinner than the MeSH and LCSH literature, partly because full Sears data are not as openly available as LCSH linked data or MeSH files. Holstrom (2021) analyses the social and cultural dimensions of Sears and shows how the list has modernized terminology and added thesaural features. Satija's concise discussion of the 22nd edition similarly identifies major changes in the scale and content of Sears, including new headings and expanded subject coverage (Satija, 2018). The present study builds on this literature by turning comparison into a coded dataset with statistical interpretation.

8. Research Gap, Objectives, and Research Questions

8.1 Research gap

The central gap addressed by this study is the absence of a compact but data-based comparison of Sears, LCSH, and MeSH using common coding variables. Existing literature often treats these vocabularies in separate institutional contexts. Sears is discussed as a practical list for smaller libraries; LCSH is discussed as a national authority and linked-data vocabulary; MeSH is discussed as a biomedical thesaurus and retrieval tool. A single comparative dataset makes it possible to examine how hierarchy, scope notes, entry terms, cross-references, and specificity differ across these systems.

8.2 Objectives

1. To compare Sears, LCSH, and MeSH as controlled vocabulary systems.
2. To examine how each system supports subject access and knowledge organization.
3. To analyse differences in hierarchy, specificity, scope notes, semantic relationships, and cross-reference structure.
4. To evaluate the relevance of Dr. M. P. Satija's subject-heading theory in contemporary metadata and digital discovery environments.
5. To identify implications for cataloguing, indexing, OPACs, digital repositories, and AI-assisted information retrieval.

8.3 Research questions

- RQ1. How do Sears, LCSH, and MeSH differ in structure, scope, semantic depth, and user-access support?
- RQ2. Which vocabulary system provides stronger hierarchical and associative relationships?
- RQ3. How does specificity vary across general, academic, and biomedical subject-heading systems?
- RQ4. How do Dr. M. P. Satija's theoretical insights help explain subject-heading construction and controlled-vocabulary design?



RQ5. What is the relevance of controlled vocabulary in the age of digital libraries, semantic web, linked data, and AI-assisted information retrieval?

9. Methodology

The study uses comparative analytical research design based on secondary data coding. The unit of analysis is the individual preferred heading, subject heading string, or descriptor. The sampling frame consisted of publicly traceable Sears headings and official documentation, LCSH headings and linked-data authority records, and MeSH descriptors and NLM documentation. The final coded sample contains 90 entries: 30 from Sears, 30 from LCSH, and 30 from MeSH.

Inclusion criteria were: (a) the term had to be a real heading or descriptor traceable to official public documentation or well-established public authority practice; (b) the term had to represent a substantive topic, form, population, domain, or object rather than a purely administrative label; and (c) the full sample had to include social, environmental, medical, technological, literary, and LIS-related domains. Exclusion criteria were: (a) unverifiable headings; (b) purely local headings with no recognized authority basis; and (c) obsolete terms not presented as replaced-heading evidence.

Fifteen variables were coded: vocabulary system, subject domain, preferred heading/descriptor, availability of scope note, broader-term count, narrower-term count, related-term count, synonym or non-preferred-term count, hierarchy level, coordination tendency, specificity score, user-access support score, cross-reference richness score, knowledge-organization function, and remarks on semantic clarity. Scores from 1 to 5 were derived by a documented rubric: higher hierarchy level, richer narrower-term structure, scope-note availability, and stronger entry-term support increased specificity, user-access support, and cross-reference richness. Because this was a single-researcher content-analysis study, formal two-coder reliability and Cohen's kappa could not be calculated; this is reported as a limitation.

The analysis is explicitly a coded-sample study. It does not claim to measure the complete population of Sears, LCSH, or MeSH records. This distinction matters most for Sears because the complete current entry-level database is not openly harvestable. The Sears sample is therefore based on public front matter, public principles, key headings, subdivisions, and canceled/replaced headings. For LCSH and MeSH, public linked-data and official documentation provide stronger authority-record transparency.

Table 1. Dataset coding framework

Variable	Measurement level	Coding rule
Vocabulary system	Nominal	Sears, LCSH, or MeSH
Subject domain	Nominal	Broad domain assigned during coding
Preferred heading / descriptor	Text	Authorized public heading or descriptor
Scope note	Binary	1 = scope note/definition available; 0 = not available in public sample
BT count	Count	Broader-term relationships visible or coded from authority structure
NT count	Count	Narrower-term relationships visible or coded from authority structure
RT count	Count	Related-term relationships visible or coded from authority structure
UF / synonym count	Count	Non-preferred, variant, entry, or synonym terms
Hierarchy level	Ordinal/count	Estimated depth of concept in hierarchy or heading string
Coordination tendency	Nominal	Pre-coordinate, strongly pre-coordinate, or post-coordinate/thesaurus
Specificity score	Ordinal, 1–5	Derived score based on hierarchy, narrowing, and domain specificity
User-access support score	Ordinal, 1–5	Derived score based on scope note, synonyms, and relationship support
Cross-reference richness score	Ordinal, 1–5	Derived score based on UF, BT, NT, and RT richness
Knowledge-organization function	Text	Main function in the vocabulary system
Remarks on semantic clarity	Text	Interpretive note on clarity/inclusiveness



10. Data Sources and Coding Procedure

The Sears component was drawn from publicly available Grey House Sears pages: the preface, principles, key headings, list of canceled and replaced headings, and subdivision list. The preface documents the continuing aim of making library collections easily available to users and identifies recent additions related to social change, digital finance, and COVID-19 (Grey House Publishing, n.d.-a). The principles page provides the theoretical basis for authorized terms, cross-references, subject-heading lists, thesauri, and specific direct entry (Grey House Publishing, n.d.-b). The key-heading and subdivision pages were used to identify pattern headings such as Native Americans, English language, English literature, United States, Presidents—United States, and World War, 1939–1945 (Grey House Publishing, n.d.-d, n.d.-e).

The LCSH component was based on the Library of Congress Linked Data Service and public authority-record practice. The LC service states that LCSH contains subject headings, subdivisions, genre/form headings, children's headings, and validation strings for which authority records have been created (Library of Congress, n.d.-a). This public linked-data infrastructure supports not only bibliographic control but also machine validation, RDF expression, and semantic-web reuse.

The MeSH component was based on NLM documentation and MeSH Browser practice. NLM identifies MeSH as a hierarchically organized terminology used for indexing and cataloguing biomedical information and provides XML, RDF, MARC 21, and other distribution formats (National Library of Medicine, 2025a). NLM documentation on entry terms and online retrieval was used to interpret synonym, tree, and retrieval support variables (National Library of Medicine, 2025b, 2025c).

Table 2. Sample coded entries from Sears, LCSH, and MeSH

Vocabulary system	Subject domain	Preferred heading / descriptor	Scope note	BT count	NT count	RT count	UF / synonym count	Hierarchy level	Specificity score	User-access support score	Cross-reference richness score
Sears	Social groups	Black people	1	1	2	1	1	2	2	3	3
Sears	Indigenous studies	Native Americans	1	1	3	1	2	2	3	4	3
Sears	Indigenous studies	Indigenous peoples	0	1	2	1	2	2	2	3	3
Sears	Gender and society	LGBTQ people	0	1	2	1	2	2	2	3	3
LCSH	Library science	Libraries	1	1	8	3	2	2	3	4	4
LCSH	Library science	Library science	1	1	6	3	2	2	3	4	4
LCSH	Library science	Subject headings	1	1	5	4	3	3	3	4	5
LCSH	Cataloguing	Cataloging	1	1	8	4	4	3	3	4	5
MeSH	Artificial intelligence	Artificial Intelligence	1	2	9	3	7	4	5	5	5
MeSH	Information retrieval	Information Storage and Retrieval	1	2	8	4	8	4	5	5	5
MeSH	Library science	Libraries, Medical	1	2	5	3	4	3	4	4	5
MeSH	Library science	Cataloging	1	2	4	3	5	3	4	5	5

Table 3. Comparative features of Sears, LCSH, and MeSH

Feature	Sears	LCSH	MeSH
Primary audience	Small and medium-sized libraries	Academic, research, public, national and international cataloguing environments	Biomedical indexing, cataloguing, and retrieval
Main structure	Selective subject-heading list and local pattern vocabulary	Large subject authority vocabulary with subdivisions and validation strings	Hierarchical domain thesaurus with descriptors, trees, entry terms, and qualifiers
Typical	Pre-coordinate but	Strongly pre-coordinate, often with	Post-coordinate searching supported through



coordination	comparatively simpler	complex subdivisions	descriptor/qualifier logic and tree explosion
Vocabulary language	Popular and accessible terms	Authorized national vocabulary; mixture of natural and technical terms	Technical biomedical descriptors with rich synonyms
Semantic relationships	Cross-references and patterns; limited open entry-level data	BT/NT/RT and variant labels in authority records, with linked-data expression	Tree numbers, entry terms, related concepts, allowable qualifiers, and explosion
Strength	Usability and local adaptability	Authority scale, standardization, and interoperability	Domain specificity, hierarchy, and retrieval precision/recall support
Limitation	Not a complete open authority dataset; lower semantic depth	Complexity, historical terminology, and training burden	Domain specificity; less suited to general-library subjects

11. Data Analysis and Statistical Techniques

The coded dataset was analysed using descriptive and inferential statistics. Frequency and percentage analysis was applied to subject domains. Means, standard deviations, medians, and ranges were calculated for specificity score, hierarchy level, synonym count, and cross-reference richness. A chi-square test of independence compared scope-note availability across the three vocabulary systems. Because specificity score is an ordinal coded variable, the Kruskal–Wallis H test was used instead of one-way ANOVA to compare specificity across Sears, LCSH, and MeSH. Spearman’s rho was used to examine the relationship between synonym count and user-access support score.

The interpretation follows two principles. First, statistical significance refers to differences in the coded sample, not to complete vocabulary populations. Second, numerical results are read together with qualitative knowledge-organization interpretation. For example, a higher synonym count in MeSH has a different institutional meaning from a higher synonym count in LCSH because MeSH entry terms are embedded in biomedical retrieval, while LCSH variants function in a broader authority-control environment.

12. Results

12.1 Subject-domain distribution

The dataset deliberately included multiple domains in order to avoid limiting the comparison to library-science terminology alone. Health and clinical medicine were more strongly represented in MeSH, while Sears and LCSH included more general social, educational, literary, environmental, and technology subjects. Table 4 reports the frequency and percentage distribution of subject domains across the 90 coded entries.

Table 4. Frequency and percentage distribution of subject domains

Subject domain	Frequency	Percentage
Environment	9	10.00
Health	8	8.90
Library science	8	8.90
Gender and society	6	6.70
Disability studies	6	6.70
Mental health	5	5.60
Migration	4	4.40
Indigenous studies	4	4.40
Clinical medicine	4	4.40
Literature	3	3.30
Economics	3	3.30
Technology	3	3.30
Education	2	2.20
Media studies	2	2.20



Information retrieval	2	2.20
Social groups	2	2.20
Semantic web	2	2.20
Digital health	2	2.20
Artificial intelligence	2	2.20
Language	1	1.10
History	1	1.10
Government	1	1.10
Religion	1	1.10
Geography	1	1.10
Metadata	1	1.10
Classification	1	1.10
Cataloguing	1	1.10
Health and gender	1	1.10
Web resources	1	1.10
Digital libraries	1	1.10
Public health	1	1.10
Information science	1	1.10

12.2 Descriptive statistics

Descriptive statistics show a clear structural gradient. Sears has the lowest mean values for hierarchy, synonym count, and cross-reference richness, reflecting its compact function as a practical list for smaller libraries. LCSH occupies an intermediate position, with stronger authority relationships and pre-coordinated specificity. MeSH has the highest mean synonym count, hierarchy level, user-support score, and cross-reference richness, reflecting its domain thesaurus structure.

Table 5. Descriptive statistics by vocabulary system

Vocabulary system	n	specificity_mean	specificity_sd	specificity_median	specificity_range	hierarchy_mean	hierarchy_sd	hierarchy_median	hierarchy_range	synonymy_mean	synonymy_sd	synonymy_median	synonymy_range	cross_ref_mean	cross_ref_sd	cross_ref_median	cross_ref_range
LCSH	30	3.07	0.25	3.00	3-4	2.70	0.60	3.00	2-4	3.50	0.86	4.00	2-5	4.87	0.35	5.00	4-5
MeSH	30	4.57	0.50	5.00	4-5	3.60	0.56	4.00	3-5	6.97	1.67	7.00	4-10	5.00	0.00	5.00	5-5
Sears	30	2.27	0.45	2.00	2-3	2.10	0.40	2.00	1-3	1.70	0.47	2.00	1-2	3.13	0.35	3.00	3-4

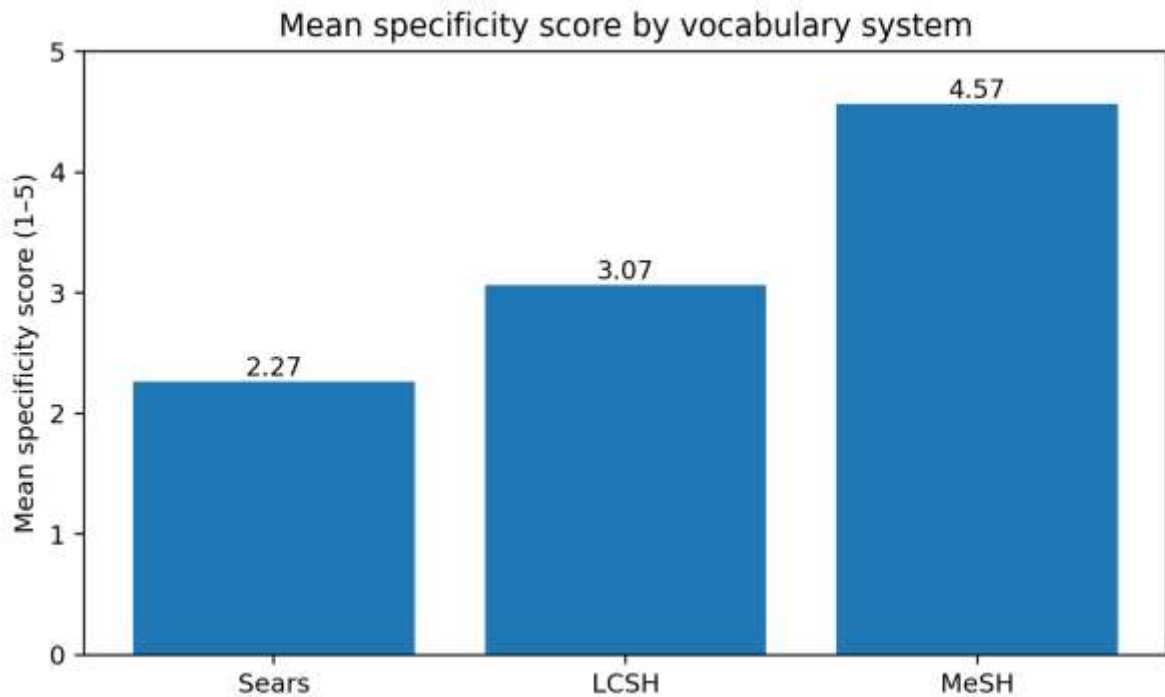


Figure 1. Mean specificity score by vocabulary system.

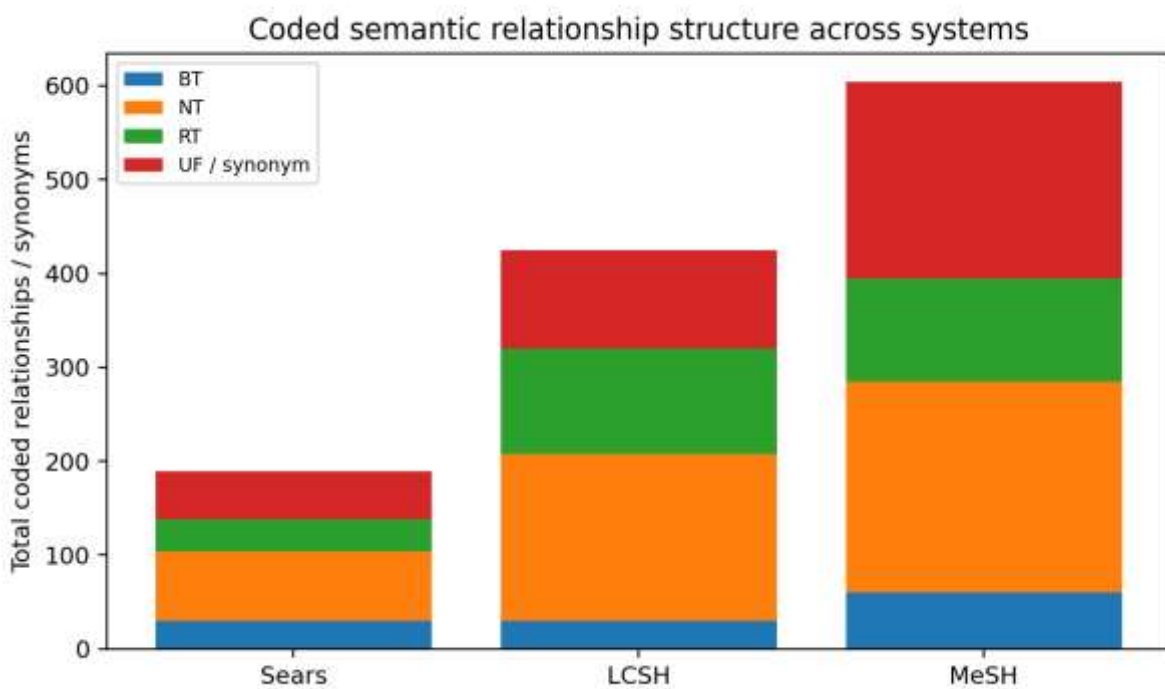


Figure 2. Stacked bar chart of broader, narrower, related, and synonym relationships by vocabulary system.

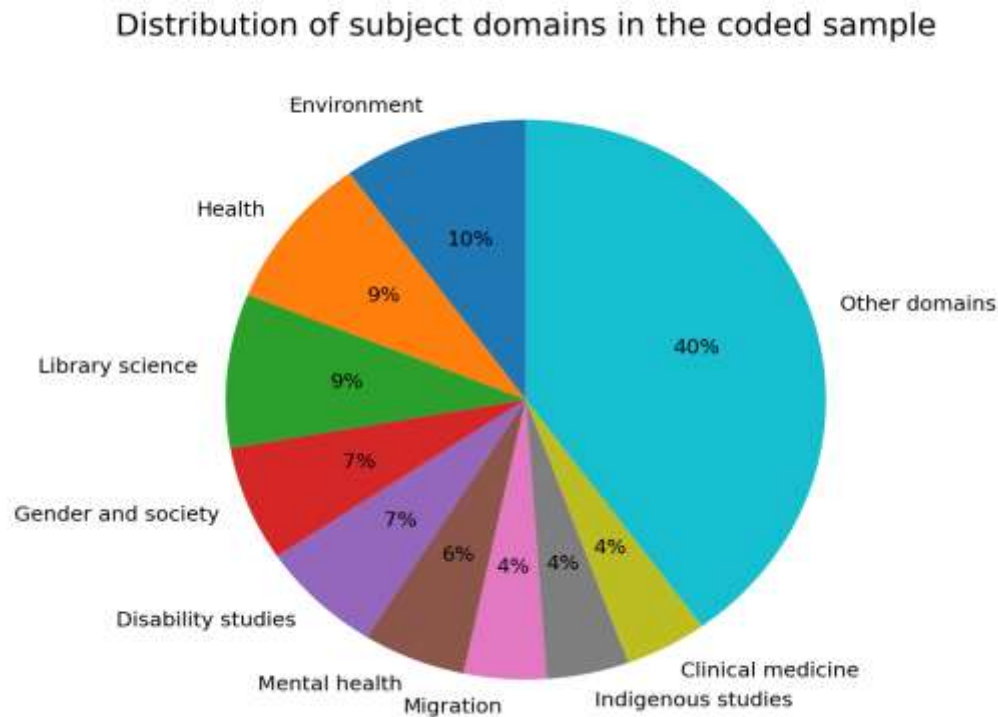


Figure 3. Pie chart showing subject-domain distribution in the coded sample.

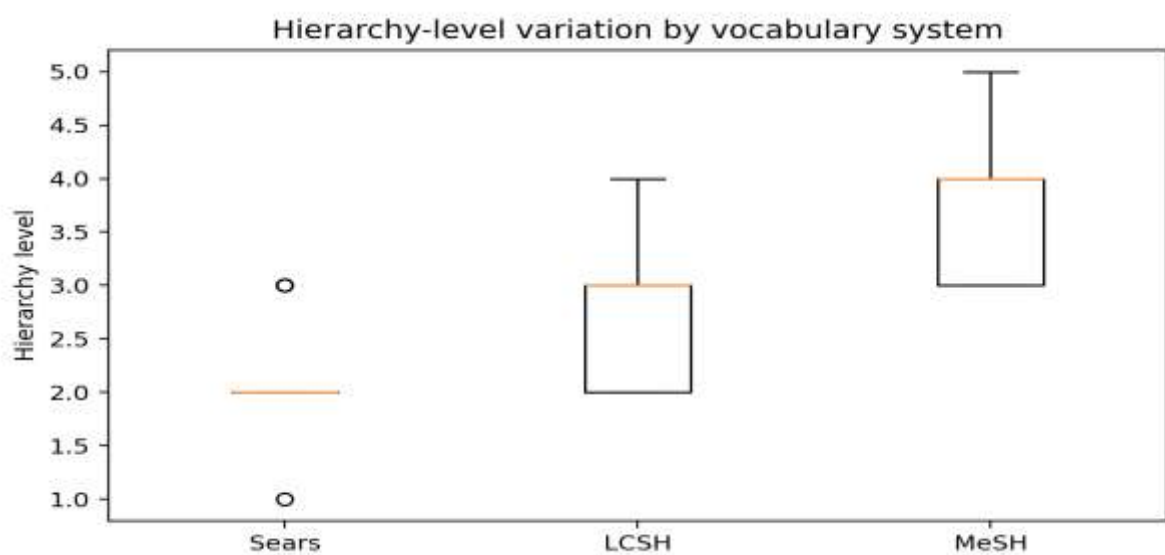


Figure 4. Box plot showing hierarchy-level variation across the three systems.

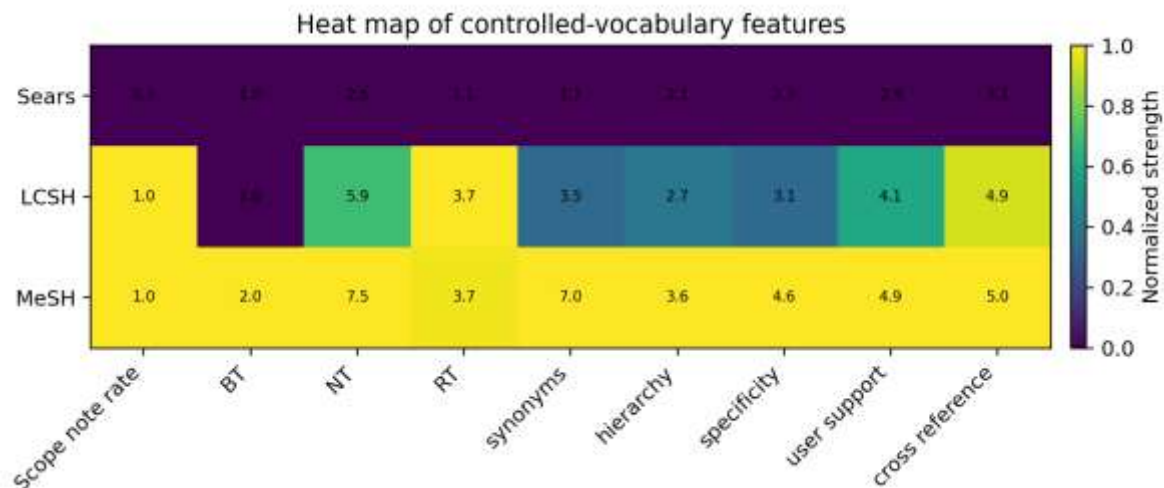


Figure 5. Heat map comparing controlled-vocabulary features across systems.

12.3 Chi-square test for scope-note availability

Table 6. Scope-note availability by vocabulary system

Vocabulary system	No scope note	Scope note available
LCSH	0	30
MeSH	0	30
Sears	20	10

Table 7. Chi-square test comparing scope-note availability

Test	Statistic	df	p-value	Interpretation
Pearson chi-square	51.43	2	<.001	Significant association between vocabulary system and scope-note availability

The chi-square test was significant, $\chi^2(2, N = 90) = 51.43, p < .001$. In the coded sample, scope-note availability was highest in MeSH and LCSH and lowest in the publicly accessible Sears sample. This result should not be interpreted as a definitive institutional count for Sears; rather, it reflects the fact that the legally visible Sears sample provides less open entry-level scope-note data than LCSH and MeSH.

12.4 Kruskal–Wallis test for specificity score

Table 8. Kruskal–Wallis test comparing specificity scores

Test	Statistic	df	p-value	Interpretation
Kruskal–Wallis H	76.07	2	<.001	Specificity differs significantly across vocabularies

Because specificity score was ordinal, the Kruskal–Wallis test was used. The test showed a statistically significant difference in specificity scores across the three systems, $H(2) = 76.07, p < .001$. The mean rank pattern corresponds to the structural interpretation: Sears provides practical but comparatively general access; LCSH increases specificity through authority control and subdivision; MeSH provides the strongest domain specificity through descriptor hierarchy and post-coordinate retrieval support.



12.5 Correlation between synonym count and user-access support

Table 9. Correlation between synonym count and user-access support score

Correlation test	rho	p-value	Interpretation
Spearman rho	0.91	<.001	Positive association between synonym richness and user-access support

Spearman correlation indicated a strong positive association between synonym or entry-term count and user-access support score, $\rho = 0.91$, $p < .001$. This supports the idea that equivalence control is not a decorative feature; it directly improves the ability of users to reach preferred terms from variant expressions.

12.6 Criteria-based comparative ranking

Table 10. Criteria-based comparative ranking of vocabulary systems

Vocabulary system	Scope_note_rate	Mean_BT	Mean_NT	Mean_RT	Mean_synonyms	Mean_hierarchy	Mean_specificity	Mean_user_support	Mean_cross_reference	Composite score	Rank
MeSH	1.00	2.00	7.50	3.67	6.97	3.60	4.57	4.93	5.00	1.00	1
LCSH	1.00	1.00	5.93	3.73	3.50	2.70	3.07	4.10	4.87	0.59	2
Sears	0.33	1.00	2.47	1.13	1.70	2.10	2.27	2.87	3.13	0.00	3

The composite ranking places MeSH first, LCSH second, and Sears third for semantic richness, hierarchy, scope-note availability, and cross-reference depth. This is not a judgment of overall usefulness. Sears is designed for smaller libraries and deliberately avoids the density of a biomedical thesaurus. Its strength is pragmatic accessibility rather than maximal semantic depth. LCSH and MeSH score higher because they operate at larger institutional and domain-specific scales.

Movement from simple authorized access to specialized semantic knowledge organization

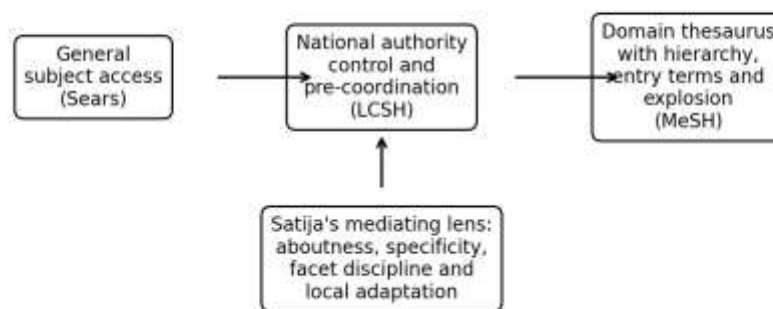


Figure 6. Conceptual model showing movement from general subject access to specialized thesaurus-based knowledge organization, interpreted through Satija's theoretical lens.

13. Discussion

The findings demonstrate that controlled vocabularies cannot be evaluated by a single criterion. A vocabulary that scores lower on hierarchy may still be highly appropriate for a small library if it provides familiar terms, simple entry, and local flexibility. A vocabulary that scores higher on cross-reference richness may be powerful for expert retrieval but burdensome for novice users. Sears, LCSH, and MeSH



therefore represent different design settlements between user language, authority control, and semantic precision.

Sears is best understood as a compact pattern language for subject access. Its lower mean scores for hierarchy and synonym richness are consistent with its public principles, which define the list as a selective foundation for small libraries rather than a complete authority universe (Grey House Publishing, n.d.-b). The result is not a weakness when judged against Sears' intended audience. Its intellectual strength lies in helping cataloguers choose direct, popular, specific headings and in giving local libraries permission to extend the list consistently. Satija's subject-heading theory is particularly relevant here because it treats the cataloguer as an active analyst rather than as a mechanical transcriber of an authority file.

LCSH occupies a middle position in the results. It is richer than Sears in authority infrastructure and more general than MeSH in domain coverage. Its pre-coordinated strings can represent complex subjects in a way that simple keyword systems cannot. However, pre-coordination also creates a syntactic barrier. Users may search naturally for a topic while the catalogue stores the subject as an authorized string with subdivisions. Linked data reduces some of this barrier by exposing identifiers and variant labels, but the intellectual design remains authority-centred. For cataloguers, LCSH requires substantial training; for users, it often requires discovery interfaces that translate authority complexity into usable search and browse features.

MeSH scores highest on semantic richness and user-access support because it is a specialized thesaurus rather than a general subject-heading list. Its descriptor trees, entry terms, and retrieval features are highly aligned with biomedical indexing. The recent retrieval literature confirms that MeSH remains valuable in systematic searching even when free-text searching is common (DeMars & Perruso, 2022; Leblanc et al., 2024). Nevertheless, MeSH is not a universal model for all libraries. Its strength depends on domain specificity, expert curation, and integration with biomedical databases. A public library could not simply replace Sears with MeSH because the two systems answer different knowledge-organization problems.

The most important theoretical implication concerns the relation between hierarchy and access. Hierarchy is often treated as a mark of intellectual superiority, but the findings suggest a more nuanced interpretation. Hierarchy improves browsing and explosion when the domain is coherent and the user understands the conceptual structure. It can become less useful when a collection is general, users are heterogeneous, and subject terminology changes quickly. Sears handles this by prioritizing familiar terminology and local adaptation. LCSH handles it by maintaining a national authority infrastructure. MeSH handles it by narrowing the domain and increasing semantic granularity.

The findings also support a social view of subject access. Vocabulary revision is not only maintenance; it is knowledge-organization ethics. Replacements such as Black people, Intellectual disabilities, Undocumented immigrants, and Female genital mutilation show that authorized language changes as communities, disciplines, and social norms change. Inclusive subject access requires mechanisms for revision, public accountability, and alternative terminology. Recent DEI metadata literature reinforces this point by treating subject headings as sites where access, representation, and power intersect (Wintermute et al., 2024).

Satija's contribution helps interpret these tensions. His classification background encourages an analytical view of subject headings: the cataloguer must determine the subject, choose a term of correct specificity, apply syntactic discipline, and maintain cross-references. His work on Sears demonstrates that a compact list can still rest on strong theoretical foundations if it provides patterns for expansion, guidance on direct entry, and a coherent understanding of subject analysis. In this sense, Satija's work bridges older cataloguing theory and contemporary metadata concerns.



14. Theoretical Implications

The study has four theoretical implications. First, controlled vocabulary should be seen as a layered knowledge-organization instrument rather than as a mere list of authorized words. Sears operates as a practical layer, LCSH as an authority-control layer, and MeSH as a domain-thesaurus layer. Second, specificity is not an abstract virtue; it is useful only when it fits the collection, user group, and retrieval context. Third, equivalence relationships are central to access because users rarely begin with the authorized term. Fourth, knowledge organization must integrate semantic discipline with social revision, especially in headings involving communities, identities, disability, migration, and health.

The paper also shows why classification theory remains relevant to subject headings. Facet analysis, aboutness, broader/narrower logic, and citation order continue to shape verbal indexing. Satija's body of work matters because it resists the separation of classification from subject cataloguing. In modern metadata environments, this integration is even more important: machine-actionable vocabularies require both stable identifiers and intellectually defensible relationships.

15. Practical Implications

For cataloguing practice, the results recommend vocabulary choice according to institutional need. Small libraries may continue to use Sears effectively if they maintain local authority files and document local additions. Academic and research libraries require LCSH because of interoperability, cooperative cataloguing, and large-scale authority control. Biomedical libraries, systematic reviewers, and health-information specialists require MeSH because keyword searching alone cannot reliably reproduce the benefits of descriptor hierarchy and entry-term mapping.

For OPACs and discovery layers, the findings support richer display of authority relationships. Users should see preferred terms, variants, broader terms, narrower terms, and related terms in ways that are understandable without cataloguing expertise. For repositories and digital libraries, controlled vocabulary should be exposed as linked data wherever possible. The LC Linked Data Service and MeSH RDF distribution point toward this direction. Sears-based libraries can also improve practice by documenting local headings and cross-references in structured, reusable forms.

For AI-assisted information retrieval, controlled vocabulary offers a safeguard against purely statistical term matching. Large language models and neural search systems can infer semantic similarity, but they may also blur distinctions, reproduce bias, or hallucinate relations. Authority vocabularies provide a curated semantic scaffold that can support query expansion, disambiguation, multilingual mapping, and explainable retrieval. The future is therefore not a choice between AI and controlled vocabulary; it is the integration of machine learning with transparent knowledge-organization systems.

16. Limitations

The study has several limitations. First, the sample contains 90 entries and is designed for comparative analysis, not for exhaustive coverage of the three vocabularies. Second, complete Sears entry-level records are not openly harvestable; therefore the Sears component is based on legally visible public documentation and headings. Third, the ordinal scores are derived from a documented coding rubric and should not be interpreted as official vocabulary-quality scores. Fourth, two-coder reliability could not be calculated because the study was coded by a single researcher. Future research should use multiple coders and report Cohen's kappa for categorical variables. Fifth, LCSH and MeSH are continuously updated, so results reflect the public source state consulted during the study rather than a permanent condition.



Despite these limitations, the analysis is useful because it makes the comparative logic explicit. It provides a reproducible framework that can be expanded by future researchers using larger samples, automated extraction from LCSH and MeSH linked data, licensed Sears data, and user-search transaction logs.

17. Conclusion

This research paper compared Sears, LCSH, and MeSH through a 90-entry coded dataset and statistical analysis of scope notes, hierarchy, synonym richness, specificity, user-access support, and cross-reference structure. The findings show a systematic progression from Sears as a practical, accessible, locally adaptable subject-heading list; to LCSH as a large-scale national and international authority vocabulary; to MeSH as a specialized biomedical thesaurus optimized for hierarchical indexing and retrieval. Statistical results supported significant differences in scope-note availability and specificity across the three systems, and synonym richness was positively associated with user-access support.

The study confirms that controlled vocabulary remains essential in contemporary knowledge organization. Keyword search alone cannot replace the intellectual work of authority control, equivalence mapping, semantic relationships, and scope clarification. However, vocabulary systems must be evaluated in relation to purpose. Sears is not weak because it is less semantically dense than MeSH; it is designed for a different context. LCSH is not obsolete because it is complex; its authority structure supports interoperability at scale. MeSH is not universally superior because it is specialized; its strength comes from domain focus and biomedical retrieval integration.

Dr. M. P. Satija's contribution is central to this interpretation. His work reminds LIS researchers that subject headings are not merely alphabetical labels. They are products of subject analysis, classification reasoning, terminological control, and user-oriented access. From Sears to MeSH, the enduring problem is the same: how to name knowledge in a way that is consistent enough for systems, specific enough for retrieval, and intelligible enough for users.

18. Recommendations

1. Libraries using Sears should maintain documented local authority files and record local additions, variants, and cross-references.
2. Academic libraries using LCSH should improve discovery-interface display of variants, broader terms, narrower terms, and related terms.
3. Biomedical and health-science libraries should continue teaching combined MeSH and text-word search strategies rather than presenting them as alternatives.
4. Metadata professionals should routinely review controlled vocabularies for inclusive language and community-sensitive terminology.
5. Future research should expand this study with licensed Sears data, automated LCSH and MeSH extraction, user-search logs, and inter-coder reliability testing.
6. AI-assisted retrieval systems should integrate controlled-vocabulary identifiers and relationships to improve transparency and reduce uncontrolled semantic drift.



Table 11. Summary of Dr. M. P. Satija's theoretical contributions

Contribution area	Theoretical meaning	Relevance to this study
Subject analysis and aboutness	Cataloguing begins by determining the true subject, not by mechanically matching title words	Supports accurate preferred-heading selection
Specificity and direct entry	Heading should be co-extensive with the subject of the work	Explains why overly broad terms reduce retrieval precision
Classification–heading connection	Classification logic and subject-heading logic are complementary	Bridges shelf arrangement and verbal subject access
Facet discipline	Complex subjects require analysis into meaningful components	Supports syntactic clarity in compound headings
Local adaptation	Compact lists such as Sears require cataloguer judgment and local authority control	Explains Sears as a pattern vocabulary rather than a complete universe
Educational contribution	Textbooks and explanations make complex systems accessible to cataloguers	Strengthens LIS pedagogy and professional practice

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Appendix A. Full Coded Dataset Used for Statistical Analysis

The following appendix gives the 90 coded entries used for all descriptive and inferential statistics. Relationship counts and scores are coded according to the rules in Table 1 and should be interpreted as study variables, not as official total counts for the complete vocabularies.

Appendix Table A.1. Full coded Sears entries (n = 30)

Vocabulary system	Subject domain	Preferred heading / descriptor	Scope note	BT count	NT count	RT count	UF / synonym count	Hierarchy level	Specificity score	User-access support score	Cross-reference richness score
Sears	Social groups	Black people	1	1	2	1	1	2	2	3	3
Sears	Indigenous studies	Native Americans	1	1	3	1	2	2	3	4	3
Sears	Indigenous studies	Indigenous peoples	0	1	2	1	2	2	2	3	3
Sears	Gender and society	LGBTQ people	0	1	2	1	2	2	2	3	3
Sears	Migration	Undocumented immigrants	0	1	1	1	2	2	2	2	3
Sears	Mental health	Bipolar disorder	0	1	2	1	2	2	2	3	3
Sears	Disability studies	Intellectual disabilities	0	1	2	1	2	2	2	3	3
Sears	Disability studies	People with disabilities	0	1	3	1	2	2	3	3	3
Sears	Environment	Biodiversity	0	1	3	1	1	2	3	2	3
Sears	Environment	Biodiversity conservation	0	1	2	1	1	3	2	2	3
Sears	Environment	Global warming	0	1	2	1	2	2	2	3	3
Sears	Health	COVID-19	1	1	2	1	2	2	2	4	3
Sears	Health	Masks	0	1	2	1	1	2	2	2	3
Sears	Technology	Cryptocurrencies	0	1	2	1	2	2	2	3	3
Sears	Economics	Crowdfunding	0	1	1	1	2	2	2	2	3
Sears	Media studies	Streaming television	0	1	1	1	2	2	2	2	3



Sears	Education	Online education	0	1	2	1	2	2	2	3	3
Sears	Technology	Personal computers	0	1	2	1	2	2	2	3	3
Sears	Library science	Libraries	1	1	4	2	1	1	2	3	4
Sears	Library science	Library classification	1	1	2	2	1	2	2	3	4
Sears	Language	English language	1	1	5	1	1	2	3	3	3
Sears	Literature	English literature	1	1	5	1	1	2	3	3	3
Sears	History	World War, 1939-1945	1	1	5	2	2	3	3	4	4
Sears	Government	Presidents--United States	1	1	4	2	2	3	3	4	4
Sears	Geography	United States	1	1	5	1	1	2	3	3	3
Sears	Religion	Qur'an	0	1	2	1	2	2	2	3	3
Sears	Gender and society	Gender role	0	1	2	1	2	2	2	3	3
Sears	Health and gender	Female genital mutilation	0	1	1	1	2	3	2	2	3
Sears	Disability studies	Hearing dogs	0	1	1	1	2	2	2	2	3
Sears	Literature	Dystopian fiction	0	1	2	1	2	2	2	3	3

Appendix Table A.2. Full coded LCSH entries (n = 30)

Vocabulary system	Subject domain	Preferred heading / descriptor	Scope note	BT count	NT count	RT count	UF / synonym count	Hierarchy level	Specificity score	User-access support score	Cross-reference richness score
LCSH	Library science	Libraries	1	1	8	3	2	2	3	4	4
LCSH	Library science	Library science	1	1	6	3	2	2	3	4	4
LCSH	Library science	Subject headings	1	1	5	4	3	3	3	4	5
LCSH	Cataloguing	Cataloging	1	1	8	4	4	3	3	4	5
LCSH	Classification	Classification--Books	1	1	5	3	3	4	4	4	5
LCSH	Information retrieval	Information retrieval	1	1	7	4	3	3	3	4	5
LCSH	Metadata	Metadata	1	1	5	4	4	3	3	4	5
LCSH	Digital libraries	Digital libraries	1	1	6	4	3	3	3	4	5
LCSH	Artificial intelligence	Artificial intelligence	1	1	9	5	4	3	3	4	5
LCSH	Semantic web	Linked data	1	1	5	4	4	3	3	4	5
LCSH	Semantic web	Semantic Web	1	1	5	4	3	3	3	4	5
LCSH	Web resources	Web sites--Metadata	1	1	4	3	2	4	4	4	4
LCSH	Health	COVID-19 (Disease)	1	1	7	4	4	3	3	4	5
LCSH	Health	Masks	1	1	4	3	2	2	3	4	4
LCSH	Environment	Global warming	1	1	6	4	3	2	3	4	5
LCSH	Environment	Biodiversity	1	1	7	4	3	2	3	4	5
LCSH	Environment	Biodiversity conservation	1	1	6	4	3	3	3	4	5
LCSH	Social groups	Black people	1	1	7	4	4	2	3	4	5
LCSH	Indigenous studies	Indigenous peoples	1	1	6	4	4	2	3	4	5
LCSH	Indigenous studies	Indians of North America	1	1	9	4	5	3	3	5	5
LCSH	Gender and society	Sexual minorities	1	1	7	5	5	3	3	5	5
LCSH	Gender and society	Transgender people	1	1	6	4	5	3	3	5	5
LCSH	Migration	Undocumented immigrants	1	1	5	4	4	3	3	4	5
LCSH	Disability studies	People with disabilities	1	1	7	4	4	2	3	4	5
LCSH	Disability studies	Intellectual disability	1	1	5	3	4	3	3	4	5
LCSH	Mental health	Bipolar disorder	1	1	5	3	4	3	3	4	5
LCSH	Economics	Cryptocurrencies	1	1	5	4	4	3	3	4	5
LCSH	Economics	Crowdfunding	1	1	4	3	4	2	3	4	5
LCSH	Media studies	Streaming television	1	1	4	3	3	2	3	4	5
LCSH	Literature	Dystopian fiction	1	1	5	3	3	2	3	4	5



Appendix Table A.3. Full coded MeSH entries (n = 30)

Vocabulary system	Subject domain	Preferred heading / descriptor	Scope note	BT count	NT count	RT count	UF / synonym count	Hierarchy level	Specificity score	User-access support score	Cross-reference richness score
MeSH	Artificial intelligence	Artificial Intelligence	1	2	9	3	7	4	5	5	5
MeSH	Information retrieval	Information Storage and Retrieval	1	2	8	4	8	4	5	5	5
MeSH	Library science	Libraries, Medical	1	2	5	3	4	3	4	4	5
MeSH	Library science	Cataloging	1	2	4	3	5	3	4	5	5
MeSH	Library science	Medical Subject Headings	1	2	4	2	4	3	4	4	5
MeSH	Digital health	Electronic Health Records	1	2	10	4	8	4	5	5	5
MeSH	Digital health	Natural Language Processing	1	2	7	4	7	4	5	5	5
MeSH	Health	COVID-19	1	2	12	4	10	4	5	5	5
MeSH	Health	SARS-CoV-2	1	2	8	4	9	4	5	5	5
MeSH	Health	Post-Acute COVID-19 Syndrome	1	2	5	3	8	5	5	5	5
MeSH	Health	Masks	1	2	5	3	5	3	4	5	5
MeSH	Environment	Global Warming	1	2	5	4	5	3	4	5	5
MeSH	Environment	Biodiversity	1	2	6	4	5	3	4	5	5
MeSH	Environment	Ecosystem	1	2	6	3	5	3	4	5	5
MeSH	Public health	Vaccination	1	2	12	4	8	4	5	5	5
MeSH	Clinical medicine	Diabetes Mellitus	1	2	12	4	10	4	5	5	5
MeSH	Clinical medicine	Hypertension	1	2	9	4	8	4	5	5	5
MeSH	Clinical medicine	Neoplasms	1	2	15	4	10	3	4	5	5
MeSH	Clinical medicine	Asthma	1	2	8	3	7	4	5	5	5
MeSH	Mental health	Mental Health	1	2	7	4	6	3	4	5	5
MeSH	Mental health	Depression	1	2	8	4	8	4	5	5	5
MeSH	Mental health	Anxiety	1	2	7	4	7	4	5	5	5
MeSH	Disability studies	Intellectual Disability	1	2	7	3	8	4	5	5	5
MeSH	Gender and society	Gender Identity	1	2	6	4	7	4	5	5	5
MeSH	Gender and society	Transgender Persons	1	2	6	4	8	4	5	5	5
MeSH	Migration	Emigrants and Immigrants	1	2	7	4	6	3	4	5	5
MeSH	Migration	Refugees	1	2	6	4	6	3	4	5	5
MeSH	Information science	Information Dissemination	1	2	6	4	7	3	4	5	5
MeSH	Education	Education, Distance	1	2	6	4	7	4	5	5	5
MeSH	Technology	Computers	1	2	9	4	6	3	4	5	5