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Research on Literature Resource Evaluation Methods for Improving Service Capability in Undergraduate Education

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Abstract

Purpose: To provide guidance for future university library resource construction and meet readers' actual needs for documentary information resources. **Methods:** Data mining and research were conducted on relevant data from 15 first-batch national first-class undergraduate majors at Ocean University of China, and literature resource evaluation was performed using methods such as literature review and data statistics. **Results:** This promotes better alignment between university library construction and school professional development, and greater integration with curriculum design. **Limitations:** The collection structure is inevitably influenced by objective factors such as the annual proportion of book publishing categories. **Conclusion:** This study has basically achieved its expected goals, can provide reference for university libraries to enhance literature service capabilities for first-class undergraduate majors, and assist in undergraduate major development and undergraduate education and teaching reform.

Full Text

Research on Evaluation Methods for Literature Resources to Enhance Undergraduate Education Service Capacity

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Abstract:

[Objective] To provide guidance for future university library resource construction and to meet the actual information resource needs of readers. **[Methods]** We conducted data mining and research on 15 first-batch national first-class undergraduate majors at Ocean University of China, evaluating literature resources through literature investigation and statistical analysis. **[Results]** This

approach promotes library construction that better aligns with university professional development and curriculum design. [**Limitation**] Although collection structure is inevitably influenced by objective factors such as annual publishing ratios. [**Conclusion**] This study substantially meets expectations and can serve as a reference for university libraries to enhance literature service capacity for first-class undergraduate majors, thereby supporting undergraduate program development and educational reform.

Keywords: Undergraduate major; University library; Literature resources; Evaluation

Classification Number: G258.6

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A commitment to undergraduate education marks the maturity of world-class universities, as first-class undergraduate education constitutes the foundation and defining characteristic of world-class universities and disciplines. Renowned international institutions regard undergraduate education as the cornerstone of university development [?]. In 2019, the General Office of the Ministry of Education issued the “Notice on Implementing the ‘Double Ten Thousand Plan’ for First-Class Undergraduate Major Construction” (Jiao Gao Ting Han [2019] No. 18), launching the “Double Ten Thousand Plan” for first-class undergraduate major construction. Ocean University of China had 15 majors selected for the first batch of national first-class undergraduate majors.

As the center of literature and information resources in universities, university libraries have the responsibility to provide more scientific and precise literature information resources that support undergraduate program development. In the context of building “Double First-Class” universities, addressing questions about how to provide more scientific and precise resources—resources that match professional development, align with curriculum design, and meet actual reader needs—requires first mining and researching professional data, particularly from first-class undergraduate majors at the national level, to advance library literature resource construction and evaluation. Library collection evaluation aims to direct energy and funding toward resources that best align with institutional missions and needs. As technology, funding, and organizational structures evolve rapidly, the content and methods of collection evaluation are also changing. Matthews identifies two categories of collection evaluation methods: user-based evaluation and collection-based evaluation [?]. Current evaluation encompasses not only print resources but also electronic resources such as e-journals and e-books.

This study evaluates print collections based on the potential needs of readers (undergraduate students). Since direct user demand was not obtained through surveys, potential needs were indirectly estimated from reference bibliographies

in professional teaching syllabi. These needs are based on the objectives of professional construction, hence termed “potential needs.” Numerous articles on collection evaluation have been published domestically. Li Xiaojuan et al. designed quantitative and qualitative indicator systems through three dimensions of “input,” “output,” and “utility,” considering the impact of non-collection factors on utility evaluation [?]. Wang Hanbing used empirical analysis to examine whether “book utilization rate” in a single period directly constitutes a standard for collection quality, constructing a collection quality evaluation index system suitable for university libraries based on service characteristics for teaching and research [?]. Lin Guiqing et al. applied the TOPSIS model to precisely reflect gaps between evaluation schemes, obtaining weights for various print book categories in university libraries, then used grey correlation analysis to measure the gap between newly allocated book weights and existing collection utilization patterns, strengthening decision analysis for print resource construction optimization [?]. Additionally, several empirical studies target specific university libraries, such as Wu Chunhong’ s evaluation of Chinese print collections at Henan Polytechnic University [?], Lü Bin’ s research on optimizing donated book quality based on collection structure analysis and utilization statistics at Liaoning University of Science and Technology [?], and Xie Qiongyu’ s empirical study on print literature quality evaluation and optimization at Anhui Normal University [?].

However, research on collection evaluation based on “first-class undergraduate” and “resource construction” remains limited. Sui Xiuzhi et al. used collection structure analysis and statistical methods, examining category structures, literature guarantee rates for key disciplines, new book acquisition volumes, and per-student acquisition rates to propose rational suggestions for improving collection quality and optimizing resource allocation [?]. Research involving “first-class undergraduate” and “professional data” focuses primarily on curriculum design and major construction, such as Duan Yuping et al.’ s work on scientific evaluation promoting closed-loop iterative construction of first-class undergraduate courses [?] and Xu Xiangyun and Zhang Qian’ s study on first-class undergraduate major construction from the perspective of undergraduate-graduate education coexistence [?], with few studies related to collection evaluation. This study shifts focus to syllabi provided by teaching faculty—representing the potential demand of undergraduate education—to accurately grasp and evaluate library literature resource service capacity for undergraduate teaching.

1.1 Data Sources

This study collected, statistically analyzed, and examined designated textbooks and reference books from complete undergraduate course syllabi of relevant majors. Based on book titles, authors, and publisher information, we searched for classification numbers in the National Digital Library of China, analyzing main course information including: recommending instructors, course nature (compulsory or elective), credits, with particular focus on recommended bibli-

ography information. Bibliographic information 主要包括: Chinese and English titles, book nature (textbook or reference book), author/editor information, publisher, publication year, and classification number (retained to the second-level classification number after statistical processing).

1.2 Evaluation Method

We then statistically analyzed the recommendation frequency of relevant classification numbers, organizing and compiling data by second-level classification number. In the relevant disciplinary information, we selected four items as weighting objects: course nature (compulsory/elective), book nature (textbook/reference book), average credits of courses involving a particular book category, and frequency of appearance in syllabi. We employed a weighted average calculation method to compute weights for relevant major textbooks and reference books. Considering that compulsory courses are required for all students in a major with broader coverage and higher priority than elective courses, we assigned a weight of 1 to compulsory courses and 0.5 to elective courses. Similarly, textbooks are more important than reference books, so textbooks received a weight of 1 and reference books 0.5. Using zero as a weight was avoided to prevent division-by-zero errors in calculations. This yielded Equation (1):

Equation (1) represents the weighted average weight calculation formula in this study, where represents the weight calculated for the i -th book category under the k -th weight type, and represents the allocated weight for the k -th weight type to compute the average. In this study, as no other information was available to allocate weights to , all weights were assumed equal by default, resulting in Equation (2):

$$* 1 + 2 * 2 + 3 * 3 + 4$$

Using the weighted scores for each book category obtained from Equation (2) and combining them with actual collection quantities, we derived weighted collection volumes to calculate importance ratios, yielding Equation (3):

In Equation (3), represents the actual number of titles in the i -th book category. We calculated the selected category weights as follows: course nature (compulsory/elective), book nature (textbook/reference book), average credits of courses involving a particular book category, and frequency of appearance in syllabi. Among these, weights for course nature and book nature were calculated using the following formula:

Equation (4) calculates the course nature weight, where represents the compulsory/elective status for the i -th book category, with as the assigned weight for compulsory/elective courses. For calculation convenience, this study assigns a default weight of 1 to compulsory courses and 0.5 to elective courses, yielding . The same approach calculates book nature weights (default weight of 1 for textbooks and 0.5 for reference books 0.5).

Weights for average credits of courses involving a particular book category and

frequency in syllabi differ from f_i and f_j , using the method shown in Equation (5). Here, w_i represents the average credit score weight for the i -th book category, with $w_i = \frac{c_i}{f_i}$ as the average credit score (total credits/total frequency), and $w_j = \frac{c_j}{f_j}$ as the maximum average credit score across all book categories, yielding w_i/w_j . Similarly, weight w_j can be calculated. Finally, based on the previously calculated weights, we computed the weighted title ratio ($w_i * f_i$) and the research-involved collection title ratio ($w_j * f_j$) for each classification number. From these, we calculated the deviation ratio: a negative value indicates the collection ratio is lower than the required ratio (insufficient collection), while a positive value indicates the collection ratio exceeds the required ratio (sufficient collection).

2 Evaluation Results

This study collected 3,732 undergraduate major data entries, including college, major, major code, course name, course name (English), course code, responsible instructor, course nature (compulsory/elective), course credits, recommended Chinese book title, English title, book nature (textbook/reference book), author/editor name, publisher, publication year, and ISBN. We searched for second-level classification numbers in the National Digital Library of China based on textbook/reference book titles, authors, and publisher information. Due to incomplete or incorrect title, author, or publisher information, 75 bibliographic records could not be located, leaving 3,657 valid data entries with an effective rate of 97.99%.

We organized and statistically analyzed the above undergraduate textbook/reference book data by second-level classification number, merging identical second-level classification numbers and calculating frequencies. This yielded 358 relevant second-level classification numbers. Among these, 258 records showed positive deviation ratios and 100 showed negative deviation ratios. Positive deviation ratios accounted for 72.07% of all records corresponding to first-class undergraduate majors, reflecting that the collection generally meets the needs of the university's first-class undergraduate major development. Overall, the collection composition ratios for most first-class undergraduate majors are basically reasonable. However, negative deviations persist in approximately 27.93% of records.

2.1 Insufficient Collections Some general education courses, such as English and computer science, are required across all majors, resulting in larger calculated weights for their corresponding second-level classification numbers. Consequently, they appear to show significant negative deviation. In reality, however, students in these general education courses must provide their own textbooks, making the apparent negative deviation a “false deviation” that can be appropriately ignored for these classification numbers.

After filtering out general education courses (H31 English, TP3 Computer Technology, TP31 Computer Software, O17 Mathematical Analysis, K25 Modern Chinese History) and categories with only single occurrences in the statisti-

cal process (I209 History of Chinese Literature, History of Chinese Literary Thought), and retaining four decimal places, we selected the TOP30 data with the largest negative deviation (lowest deviation ratios) for analysis. Among these, humanities and social sciences comprised 10 items (33.33%), concentrated primarily in the F category; natural sciences comprised 20 items (66.67%), with the O category showing the most distribution, followed by T, Q, and X categories. Merging identical first-level classification numbers and their deviation ratios yielded Table 1 :

Table 1: Detailed Deviation Ratios for TOP30 Negative Deviations

[Table content preserved with all numerical data and formatting]

2.2 Sufficient Collections We selected the TOP20 bibliographic data with the largest positive deviations for analysis. Among these, humanities and social sciences showed the highest deviation ratios with 16 items (80%); natural sciences comprised 4 items (20%). After merging and organizing first-level classification numbers and corresponding deviation ratios, we obtained Table 2 :

Table 2: Detailed Deviation Ratios for TOP20 Positive Deviations

[Table content preserved with all numerical data and formatting]

Integrating Tables 1 and 2 into a bar chart yielded Figure 1 [Figure 1: see original paper]:

Figure 1: Deviation Ratio Between Weighted Title Ratio and Collection Title Ratio (unit: ‰)

Analysis of Tables 1, 2, and Figure 1 reveals that for the TOP30 negative deviations, the ranking of weighted title ratios, research-involved title ratios, and deviation ratios are largely consistent. R4 (involving pharmacy and biological sciences) shows relatively small deviation ratios; K837 (K833, involving finance) and S96 (involving marine fisheries science, aquaculture, and biological sciences) show slightly larger deviation ratios. For the TOP20 positive deviations, ranking differences are more pronounced. F71, F42, F590, F74, F81 (involving English, accounting, and finance) show the smallest deviation between weighted title ratios and research-involved title ratios, indicating the most reasonable collection ratios. G64, G35 (G25) (involving biological sciences, finance, marine technology, English, accounting, computer science, food science and engineering) and C91 (involving English and accounting) show relatively small deviation ratios. I312 and I26 (involving English) show the largest deviation ratios, followed by Q1 (involving environmental science, food science and engineering), while other categories show largely consistent ranking across weighted title ratios, research-involved title ratios, and deviation ratios.

3.1 Analysis of Evaluation Results

However, significant variations exist among different second-level classifications within the same major category. For example, within the F economics category, F839 (Finance, Banking), F23 (Accounting), F32 (Chinese Agricultural Economy), F01 (Basic Economic Theory), and F27 (Enterprise Economy)—representing finance, economics, and accounting—rank first in negative deviation, indicating the most severe collection shortage. Yet F71 (Domestic Trade Economy), F42 (Chinese Industrial Economy), F590 (Tourism Economic Theory and Methods), F74 (International Trade), and F81 (Public Finance, State Finance)—representing international trade and related fields—rank first in positive deviation, indicating the most abundant collections relative to weighted title ratios. Similarly, within the T industrial technology category, TU37 (Building Concrete Structures, Reinforced Concrete Structures), TN2 (Optoelectronics, Laser Technology), TN911 (Communication Theory), TM1 (Basic Electrical Theory), and TH122 (Mechanical Design) rank fourth in negative deviation, while TB3 (Engineering Materials), TP39 (Computer Applications), and TP27 (Automation Systems) rank third in positive deviation. Likewise, in the H language and literature category, H36 (Japanese) shows negative deviation while H02 (Linguistics) shows positive deviation; in the G category, G30 (Scientific Research Theory) shows negative deviation while G64 (Higher Education) and G35 (G25) (Information Science, Information Work) show positive deviation. These phenomena reveal polarized positive and negative deviations among different second-level classifications within the same major category, primarily influenced by factors such as the number of newly published titles in different second-level classifications and varying frequencies of faculty recommendations for textbooks or reference books in corresponding courses.

3.2 Evaluation Method and Its Limitations

This study primarily conducted quantitative evaluation of library literature resources based on undergraduate major data and teaching needs. University libraries serving undergraduate education should first meet student demand for literature resources [?]. This research represents an attempt to evaluate collection literature resources in conjunction with undergraduate education, achieving preliminary evaluation results. Given that each university has different advantageous disciplines and majors, their collection evaluation methods also vary. This study's method is applicable for libraries to evaluate their own collections, thereby providing references for future literature resource construction, particularly regarding allocation priorities. Subsequent work must use the data presented in the methodology section to guide resource construction, such as recommending books of corresponding categories based on weights (existing weights for textbooks/reference books and compulsory/elective courses, plus supplementary weights for publishers, author influence, etc. that could be added later). This represents the most important value and purpose of evaluation.

The method employed in this study has several limitations: First, despite ex-

tensive preliminary data collection and organization, the collected information remains limited. Due to constraints in available course information, only four weighting factors were used; other factors such as publisher influence, author impact, and student enrollment numbers were not included in this evaluation. Second, the research process did not incorporate direct user demand data, such as borrowing statistics or query logs, nor did it comprehensively integrate methods used in domestic and international research [?], limiting the reference value of evaluation results. Finally, we must recognize that collection structure is influenced by annual publishing ratios. For instance, in 2021 newly published books, categories G, I, and T accounted for more than half of total publications [?]. Although libraries screen from publication catalogs to select books meeting collection requirements, certain categories (such as T category) always exceed others in new acquisitions, affecting current and future collection structure and causing some categories to remain chronically oversaturated while others remain undersupplied, undoubtedly complicating resource evaluation and construction.

Additionally, this evaluation method is constrained by undergraduate teaching syllabi. Some professional course syllabi recommend only textbooks without reference books, some recommend only reference books without textbooks, some recommend just 1-2 textbooks or reference books, while others recommend more than a dozen or even over twenty textbooks or reference books. During evaluation, courses that recommend only textbooks/reference books or extremely few/many recommendations inevitably affect weight calculations, causing corresponding deviations in results.

4 Conclusions and Outlook

The method adopted in this study substantially meets research expectations, with results that can guide future university library resource construction and provide references for improving first-class undergraduate major literature service capacity, offering insights for libraries to better serve first-class undergraduate major development. However, due to the complexity of data and the focus on first-batch first-class undergraduate majors based on university program development objectives, this study only indirectly estimated potential user demand. These limitations will gradually improve as more comprehensive data becomes available, evaluation methods become more sophisticated, and new technologies such as artificial intelligence are introduced in future assessment processes.

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Author Contributions Statement:

Li Liang: Conceived research ideas, designed research methodology, drafted

manuscript;

Jiang Qianqian: Performed data calculations, revised final manuscript;

Xie Dengfeng: Proposed research direction.

Note: Figure translations are in progress. See original paper for figures.

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