

# A Normal University's Disciplinary Instruction: A Close Look at Book Lending

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## Abstract

To investigate rules that represent the reader group's reading preferences and support disciplinary instruction at a normal university, the researcher collects library borrowing data from 10 departments from 2013 to 2022 at Nanjing Normal University (NNU) as the research samples and divides the 10 departments into three groups based on the peak data load of borrowing. The researcher creates a number matrix to represent the recurrent number of books department readers borrowed in order to ascertain the affinity of faculties, uses SPSS modeler and SPSS to develop an apriori model for the study of the association rules of borrowed books as well as multivariate linear equations for the impact of significant departments on various sorts of book borrowing, applies the Kruskal-Wallis H test to see if there are any differences in the borrowing of literary works among the four departments in Group II, and uses Gephi to construct co-borrowing network diagrams of the Top 10, Top 100, Top 300, and Top 500 books in a department in order to visualize repeated borrowing in an intelligible way. This study sheds light on university lecturers' and students' reading habits from the perspective of library borrowing statistics.

## Keywords

Teacher Education, Book Borrowing, Discipline, Statistics, SPSS

## 1. Introduction

The discipline itself is frequently invisible to students and taken for granted by instructors, despite the practically universal general education requirements for students to take courses across disciplines (Russell, Littler, & Chick, 2022). On the one hand, professors habitually pose students with chain problems directly to stimulate their thinking and advance their literacy, but on the other, students

appear to be growing more disengaged from an aspect of academic activity that they find strange and opaque, which is contrary to the goals of professors to develop them, as seen from teachers' experiences as they help students with reference and academic literacy practices (Gravett & Kinchin, 2021). Resistance to education is the reality of a dissonant educational experience that goes beyond instructional pedagogical imposition; it is an education against communal, social, and institutionalized behavior, as well as a challenge to educational requirements that might be subtle or overt (Bojesen, 2023). Universities have come under fire for failing to implement changes in response to student feedback. Students' failure to complete the loop can be a source of dissatisfaction and is frequently cited as one of the causes of their low response rates to surveys and other types of consultation (Hughes, 2023).

Since the lack of novelty in the issue materials and the alienation of scenarios from real-life difficulties frequently result in a calm and drowsy classroom environment, according to these scholars, any significant and long-lasting movement in this direction depends on a fundamental cultural transformation within universities that is characterized by a shift in authority away from academics and university administrators towards students (Hughes, 2023). The degree to which students' fundamental psychological demands for autonomy, competence, and relatedness are met during collaborative learning may be what makes these distinctions (Leeuwen, Hornstra, & Flunger, 2023). **How to strike a balance between conveying topic knowledge and students' willingness to learn new things is the main problem in educational practice.**

In the course of academic research, book references not only represent the study's academic standing and the author's attitude and qualifications as a scientist, but also the meaning and worth of the paper itself. They can direct students towards additional study, save time by avoiding tedious tasks, and offer valuable information and academic value. Following topic selection, the supervisor generally guides graduate students in the information-gathering process by directing them to specific books and advising them as to which institution and platform would provide the most useful material. It is also vital to teach them how to distinguish between lying and authenticity, as well as how to draw out the essence from coarseness, in order for them to understand the authoritative literature that has been gathered. The teacher may be directly questioned by students about book recommendations. Students might ask the instructor to suggest some books they feel are worthwhile to read based on their professional expertise or describe their reading goals, such as to widen their perspectives, develop certain abilities, foster interests, etc., so that teachers can more effectively recommend books that fit their needs. Some students may tell the teacher or librarian what kinds of books and subjects they are interested in, which will help the teacher or librarian provide more precise recommendations.

Whether readers filter books using the library's online public access catalogue (OPAC) or do a direct search on the desired bookshelf, borrowing books is a de-

liberate action. The progress of human civilization is largely based on books. Readers can develop original ways of thinking in addition to knowledge through consistent reading. Records of books borrowed reveal adjustments in one's thinking, feelings, attitudes, and other areas. Departmental book reading using data mining technology to collect feature statistics can help teachers gain feedback on the learning needs of the student population. In 2008, Google released Google Flu Trends, which was able to accurately forecast the spread of H1N1 in 2009. According to a study done by Google engineers, the number of searches for information regarding the flu and allergies significantly rises throughout these seasons. People who don't have any symptoms won't search for relevant terms. The quantity of keyword searches helps us comprehend the frequency and distribution of diseases. Another notable illustration of how big data analysis is used in marketing is the well-known Wal-Mart "beer and diaper" sales. Big data analysis allows us to effectively promote marketing initiatives by revealing the relationships between products and consumer purchase patterns. **By analyzing book circulation data, educators and librarians can learn more about their readers' and students' reading preferences, close the information generation gap in teaching and learning, and broaden the range of teacher-student topic exchanges for creating course content.**

## 2. Related Literature

### 2.1. Previous Research

Deep learning, dialogic learning, and critical thinking are skills that people need for studies, employment, and daily life. These qualities promote other abilities, including media and information literacy, problem-solving, creativity, collaborative learning, and effective communication (Saripudin, 2023). The sciences, technology, engineering, and mathematics (STEM) professionals assert that in addition to verbal and mathematical proficiency, success demands a keen visual and spatial imagination, hand-eye coordination, model-making and model-interpreting expertise, as well as an extremely developed aesthetic or artistic sense. Significant relationships exist between artistic, musical, literary, and craft activities and indicators of STEM achievement like the number of patents, Nobel Prizes, or firms formed (Root-Bernstein, 2015). Transdisciplinarity instead aims to decouple a discipline's unique vocabulary from its original context, creating new opportunities for looking at and experiencing the same event from diverse angles (Burnard, Colucci-Gray, & Cooke, 2022). The manner in which researchers look for new terms to explain natural phenomena by pulling from many and frequently discontinuous worlds of personal experience suggests that transdisciplinarity lies at the foundation of creative scientific thinking. Although knowing the limits of a research subject does not guarantee that a researcher will produce high-quality work, doing so is becoming increasingly difficult in this age of information overload.

The sector of libraries and information has also been increasingly interested

in big data research and application techniques. With more studies being done on consumer preferences recently, deep learning-based recommendation algorithms have drawn a lot of interest from academic and industrial researchers, and numerous new algorithm models are proposed every year. By contrasting various groups of trials on publicly available and custom-built data sets, the efficiency of a small data fusion algorithm model in the personalized selection of library materials is demonstrated (Xiao, Liu, & Xu, 2023). In order to better understand reader and user demands, capture the possible collaborative filtering information between users and OPAC, and offer helpful support for the next personalized recommendation research, researchers focus on algorithmic literacy: Current digital literacy or information literacy regimes do not provide the level of knowledge, understanding, or skill necessary to navigate the implications of AI or use it responsibly (Ridley & Pawlick-Potts, 2021). It is clear that the intelligent application and mining of school-based data have practical implications.

Although librarians are able to gather a lot of data from a variety of sources, the largest problem is frequently turning the data into something useful that will support a strategic objective. For instance, along with helping people locate the information they need as fast and effectively as possible, instructional librarians at Indiana State University's Cunningham Memorial Library are given the freedom to adapt their information literacy curricula in light of users' search abilities (Gustafson, 2018). Based on activity logs made by users, a public library uses its space and provides key information to assist in decision-making for efficient operation (Kim, Gang, & Oh, 2020). Many real-world applications depend on the semantic understanding of brief messages, analyzing short texts infers discriminative and coherent latent subjects. Short text topic modeling has already garnered a lot of interest from the machine learning research community in recent years (Qiang et al., 2022). Topic evolution analyzes the evolution of subjects through time and provides current changes in research trends. Researchers can automatically extract changes in a topic or a branch of inquiry from research publications by observing changes in the word vectors that have been used to represent the topic over time (Jung & Yoon, 2020).

In order to analyze and evaluate outcomes for research studies in library information science, a statistical approach is essential. Statistical methods can be classified into four categories in library information science: descriptive methods, parametric inferential methods, nonparametric inferential methods, and predictive methods (Ibrahim, 2021). To evaluate statistics on electronic usage, the College of New Jersey Library used statistical techniques and the R computer language (Wang & Mi, 2019). An academic library in the Southeast of the United States examines the circulation and interlibrary loan data for the collection of fine art print books to gain a quantitative analysis utilizing descriptive and inferential statistics to provide a clearer understanding of the relationships between the circulation of subtypes of titles within the fine arts range, user groups (facul-

ty, graduate students, undergraduate students), and the publication date (Decker, 2023). The University of Liberal Arts Bangladesh library uses statistics to show the usage of the JSTOR Digital Library and how to increase its usage (Hossain, 2022). **However, it has not been regularly attempted in earlier research on libraries to analyze library book circulation data to support disciplinary instruction in teacher education.**

Positive teacher-student connections are believed to be correlated with the best and most comprehensive learning, according to the educational psychology model known as person-centered education. This approach is inspired by counseling. Both the contemporary constructivist learner-centered paradigm and classical humanistic education are included (Cornelius-White, 2007). Confucius advocated for instructing students in accordance with their individual aptitudes thousands of years ago. To better understand each student's unique learning needs, the ancient private teachers employed exploratory teacher-student Q&A. In the higher education system, flipped classes have replaced teacher-centered instruction with student-centered learning. The students in this study feel that the most important aspect of the flipped classroom is its potential to foster greater student interaction and learning (McLean & Attardi, 2023). Teachers collaborate with their students to co-author new ways of doing and knowing by actively participating in "making with" them. However, different groups collaborate more successfully than others. The idea of communicative rationality contributed to explaining a large portion of the appeal of this peer-assisted learning method (Jayathilake & Huxham, 2023). Additionally, they ought to allow enough time and space for such inquiries and interruptions (Burnard, Colucci-Gray, & Cooke, 2022).

Teachers' professional development is crucial to the effort to raise the quality of instruction and students' academic accomplishment. The implications for professional development are essential for teacher learning (Korthagen, 2017). The level of engagement and activity, the degree of reflection in the courses, the flexibility of the context, and the level of teacher collaboration affect teacher education (Bremner, Sakata, & Cameron, 2023). Teacher learning encompasses cognitive, emotional, and motivational aspects and is largely unconscious. When teacher candidates take true responsibility for the educational process, they transition from being passive recipients or consumers to active agents (Bovill et al., 2016). If used to help higher education institutions identify answers to their most pressing problems, the use of various data mining tools can be seen as laying the framework for systemic change and having a big positive influence, although it is still in its early stages (Aldowah, Al-Samarraie, & Fauzy, 2019). Deep and comprehensive guidance is achieved by association analysis, which makes use of big data technologies to identify the link between data or attributes from the vast amount of data in the library database. **Through a close examination of book lending statistics, the study seeks to support disciplinary instruction at a normal university.**

## 2.2. Research Background

There isn't a definite line dividing one discipline from another in the early stages of scientific progress. People began to comprehend that the in-depth requirements of academic research must categorize and hone scientific information at the end of the 15<sup>th</sup> century. They eventually established the independent disciplinary standing of traditional subjects like literature, philosophy, mathematics, physics, chemistry, geography, biology, history, etc. at the beginning of the 20<sup>th</sup> century. Soon after, it becomes challenging to separate complex problems into discrete disciplinary solutions. Undoubtedly, it involves the collaboration of knowledge from several fields. Towards the middle of the 20<sup>th</sup> century, disciplines started to reappear. Several interdisciplinary fields (like physical chemistry and molecular biology) are starting to emerge in large numbers.

A classification system in a library represents the logical relationships between related themes. In Chinese library classification (CLC), discipline also functions as an artificial knowledge categorization system. All subject books are divided into several broad groups in accordance with their subject content using the book classification vocabulary, which is based on the content, form, genre, and reader purpose of the book. A classification vocabulary is a list of categories and hierarchical class numbers. Many subcategories fall under each major group, and each subcategory is further broken down into subcategories. Each category has a class number, and each category can be used to categorize different types of books. For example, literary books are concentrated under category I, educational books are concentrated under category G, legal books are concentrated under category DF, historical books are concentrated under category K, technical books are concentrated under category T, and so on.

The collocation categorization of books with multidisciplinary themes, such as those with two or three subject areas, is also an issue with book cataloging in university libraries. Generally speaking, multi-subject books with subordinate relationships ought to typically be categorized in their superior category, but if the books are focused on smaller themes, they ought to be categorized in accordance with the characteristics of the smaller topic. Books that cover multiple topics and are related in parallel are categorized based on their length, main ideas, or prior themes. If many parallel themes fall under the same upper class, they are grouped together under that upper class. A multi-topic book on causal linkages is typically categorized based on how the outcome is viewed. However, a book is categorized in accordance with the theme of the cause if it covers a subject that has various consequences.

Normal universities have historically been used to describe higher education institutions in China that train a range of teachers. Modern universities, however, have a relatively simple history of promoting the arts, sciences, and engineering in addition to carrying out the job of producing high-level teachers. Nanjing Normal University (NNU), founded in 1902, is a comprehensive university focusing on teacher training. 28 departments are now present. The central location for all

types of scholarly writing materials is a university library. An estimated 5 million books are housed in the library of Nanjing Normal University.

Readers utilize a book class number, which a librarian assigns using the concepts of knowledge categorization and logical processes, to locate books. The library management system keeps track of reader requests, borrowing, returns, and overdue volumes automatically. The primary statistical indicator used by libraries to categorize results is the number of the book category. The goal of this study is to identify a set of uniform guidelines that accurately represent the reader group's reading preferences among the 100,000 or more book borrowings that are annually reported.

### 3. Theoretical Framework

When numerous individuals and books interact with one another, each component can function independently of the others or be coupled in sets of two, three, four, and so on. According to the law of combination, the combination of interacting elements will grow exponentially as the number of elements rises. In general, the total number of subsets that can exist for a set of  $n$  elements is  $2^n - 1$ . If 10 departments are chosen for this research, the total number of potential subgroups is 1023. However, we rarely employ as many categories as the four-color themes: Only four colors can be used on any map to represent nations that share boundaries. When preprocessing data, we sometimes also need to identify the links between the internal data in addition to the general features. Data grouping is utilized here. To identify the internal laws and linkages of many elements that influence borrowing behavior, this study divides the borrowing data into some groups based on the internal characteristics of the borrowing data, such as department, time period, reader type, and book kind.

According to the law of proximity, elements that are adjacent to one another are frequently regarded as a group. An important foundation for research grouping is the peak data load of borrowing. We first consider if a certain value—a data lump—occurs excessively frequently. If such phenomena don't exist, broaden our search to include other numerical instances of lumps or enlarge the definition of lumps to improve our chances of finding them. The most popular book types for each department, the most popular book types for each reader, the departments and years when each type of book is most frequently borrowed, and other indicators are crucial cues for us to look for data lumps.

Mathematicians can explain such allegedly astounding coincidences using the law of big numbers, which states that extremely rare, odd, bizarre, or bizarre events can also occur if the sample size is large enough. You feel that you and that person have something special in common when you meet someone who has borrowed the same book from the library as you. The apriori technique is used in this study to mine frequently occurring item sets and identify association rules that satisfy the minimal support and minimal confidence thresholds. The analysis for this study is done using library circulation data from 2013 to 2022 at



Nanjing Normal University. A collection of values for a single statistical indicator over a period of ten years that are arranged chronologically is known as a time series. Time series analysis of library circulation data is primarily used to reflect changes in college students' reading preferences, describe the status and outcomes of phenomena as they develop, identify development trends, and estimate growth rates. It is also used to compare readers from various departments and make future predictions based on historical data.

## 4. Data & Methods

### 4.1. Sample

The research selects borrowed records from 10 departments as the research samples: the faculties of literature, education, law, human and social development, mathematics, foreign languages, geography, chemistry, biology and physics. These ten departments have the most students, readers, and books borrowed at NNU since they have a long history with the university. About half of the books borrowed annually are taken out by these ten departments, which may be an accurate representation of the department's primary borrowing habits. Some of these 10 departments, like literature, foreign languages, etc., have significantly more female students than male students, while others, like mathematics, physics, etc., have significantly fewer female students than male students. The impact of gender differences between men and women is not considered in this study since this topic will be covered separately in another paper.

### 4.2. Analytical Strategy

The research carries out book-to-department matching (see **Figure 1**) based on the peak data load of borrowing and divides 10 departments into three groups.

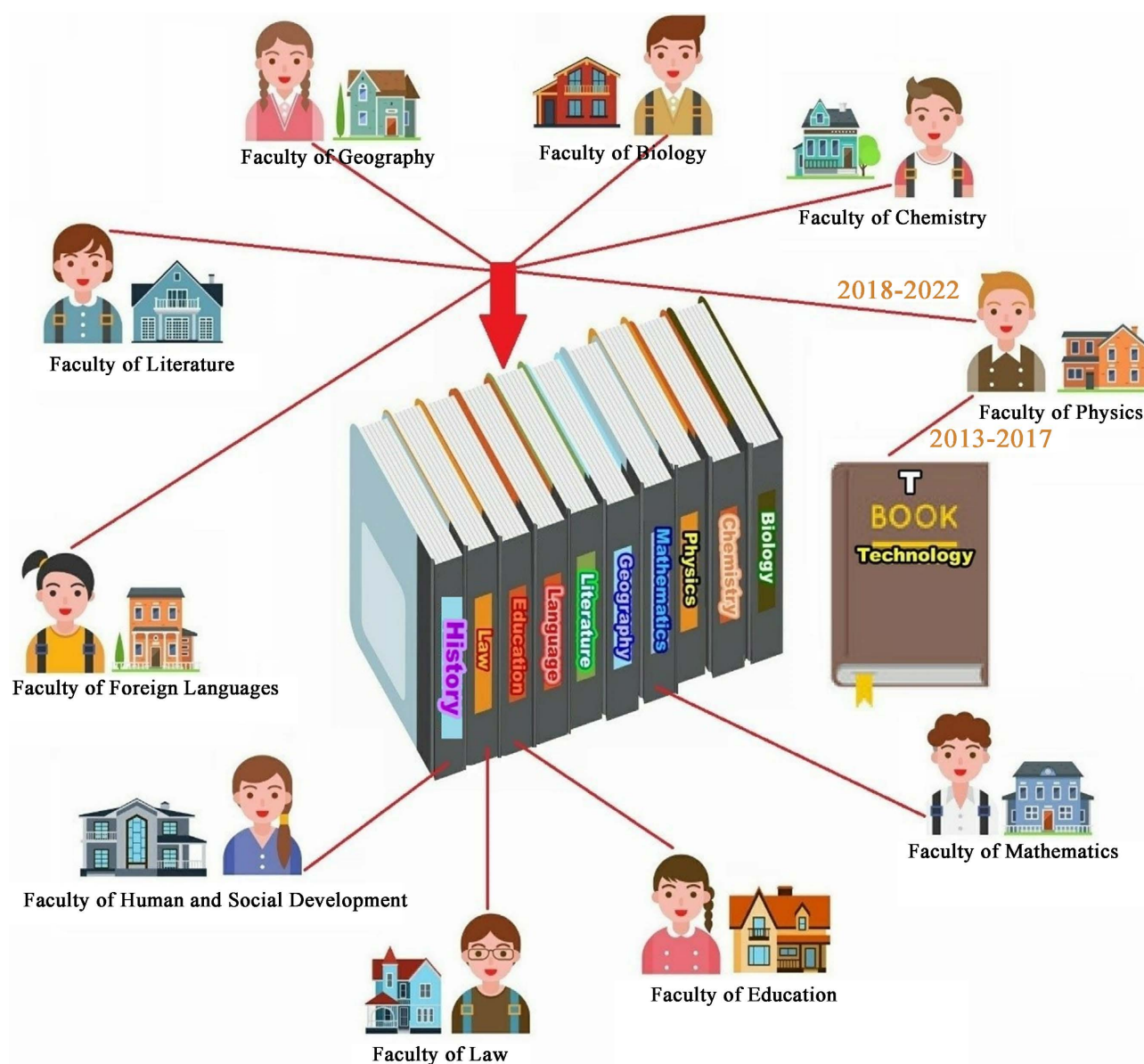
Group I: Subject first. Teachers and students borrow the most subject-specific books, including those from the faculties of education, law, human and social development, and mathematics. This group also includes the faculty of literature, whose major is congruent with the fact that it has the most literary book borrowings.

Group II: Literary first. Teachers and students borrow the most literary books, surpassing subject books, including those from the faculties of foreign languages, geography, chemistry, and biology.

Group III: Subject second. Physics faculty members borrowed the most technology books between 2013 and 2017; however, between 2018 and 2022, it was literary books. In terms of borrowed physical books, second place.

For the purpose of comparing changes, the researcher separates the borrowed book data into two groups during a 5-year period: 2013-2017 and 2018-2022. **Figure 2** displays the types of book borrowing for the five departments in Group I. **Figure 3** displays the types of book borrowing for the four departments in Group II. **Figure 4** displays the types of book borrowing for the faculty of physics in Group III.





**Figure 1.** The types of books borrowed the most by 10 departments.

To determine the affinity of faculties, the researcher develops a number matrix to characterize the repeated number of books department readers borrowed. To create an a priori analysis model for the association rules of borrowed book analysis, the researcher uses SPSS Modeler. For the analysis of the impact of major departments on various types of book borrowing, the researcher creates multivariate linear equations using SPSS. The researcher applies the Kruskal-Wallis H test to see if there are any differences in the borrowing of literary works among the four departments in Group II. To determine whether there is a difference in the overall distribution of literary book borrowing among readers from four departments as well as whether there is a difference in the overall distribution of borrowing of each literary book that readers from four departments borrow.

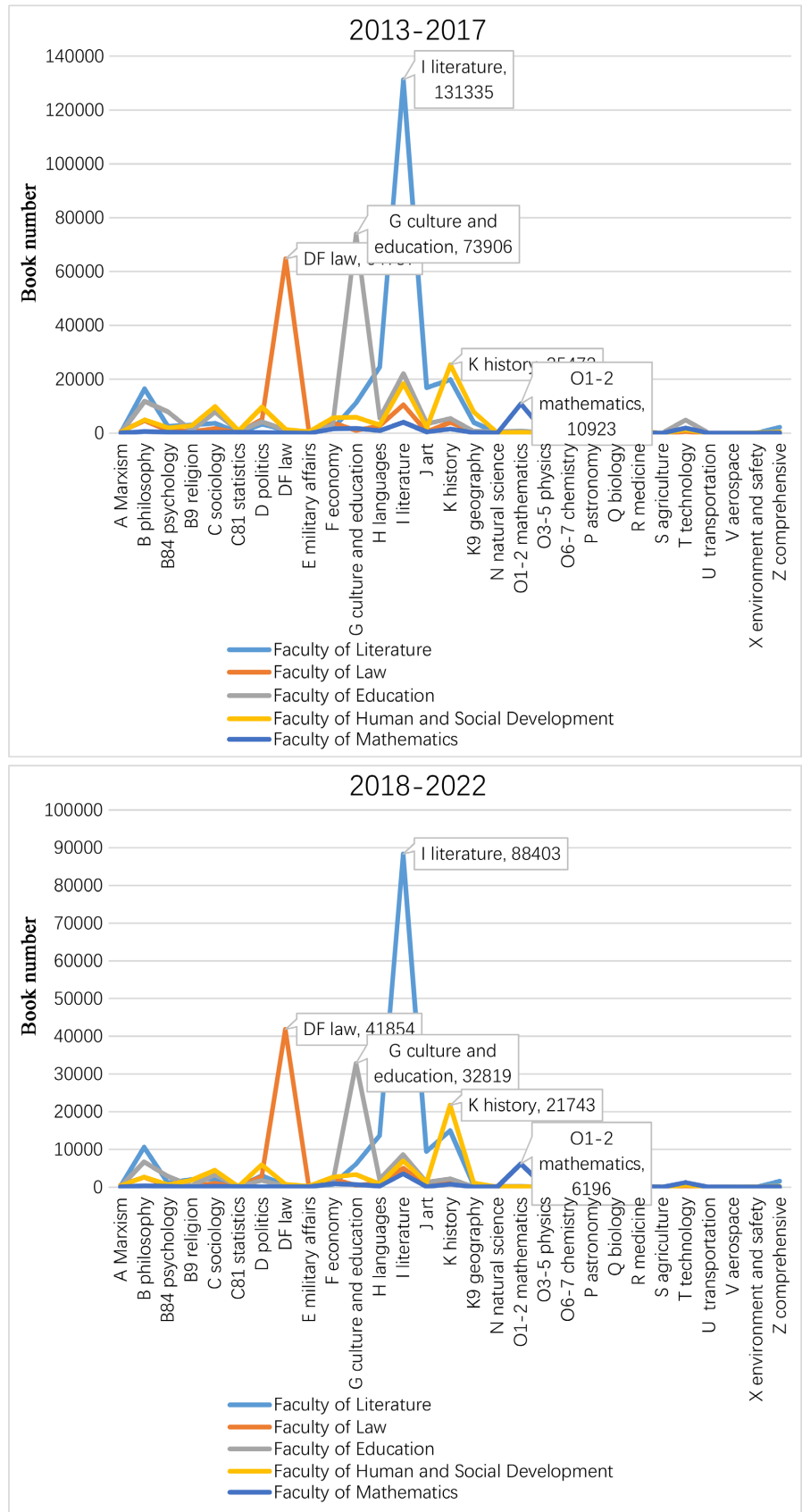


Figure 2. Comparison of book borrowing types in Group I.

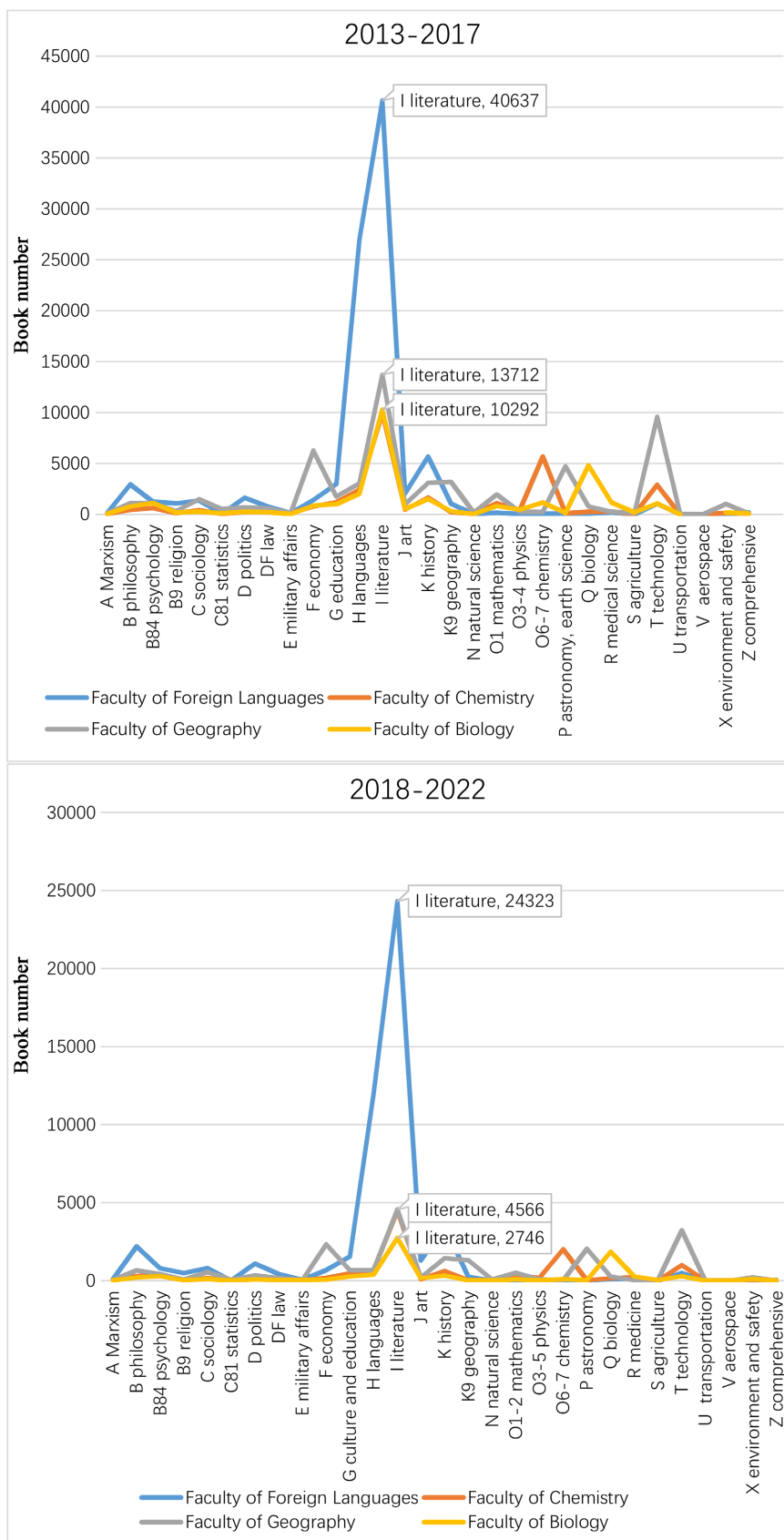


Figure 3. Comparison of book borrowing types in Group II.

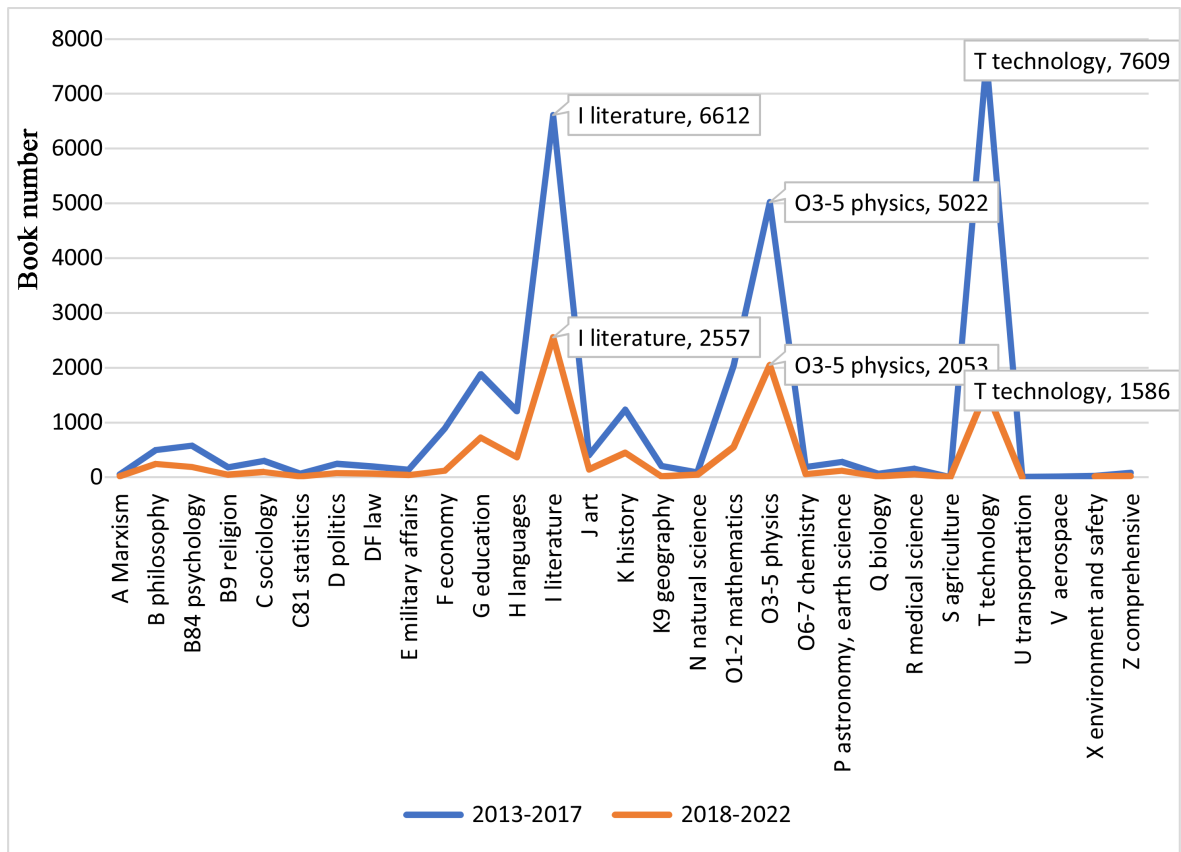


Figure 4. Comparison of book borrowing types in Group III.

In order to portray repeated borrowing in an understandable manner, researchers utilize Gephi to create co-borrowing network diagrams of the Top 10, Top 100, Top 300, and Top 500 books in a department.

## 5. Results

### 5.1. Repeated Book Borrowing Statistics

The faculties of literature and foreign languages have the strongest affinity. The pandemic made this dominance even stronger. Between 2013 and 2017, the faculty of education came in third, but during the epidemic, this advantage substantially diminished. Between 2018 and 2022, the faculty of human and social development came in third. This advantage grew during the pandemic. The faculties of mathematics, physics, and biology are the most exclusive. There are dependable book co-borrowing departments in the faculties of law, education, human and social development, foreign languages, and literature. The co-borrowing relationships between the faculties of education, literature, foreign languages, and human and social development are the greatest. The faculty of law shares most borrowed books with the faculties of literature, foreign languages, and human and social development. Before and during the epidemic, there were shaky book co-borrowing departments in the faculties of geography, chemistry, biology, mathematics, and physics. During the epidemic, the faculty of

education's affinities was progressively fading. Geography and human and social development, mathematics and foreign languages, and physics and foreign languages have taken on the roles of co-borrowing links between the faculties of geography and education, mathematics and education, and physics and education. The faculty of geography's affinity was also progressively deteriorating. Chemistry and law and biology and chemistry have taken on the roles of co-borrowing arrangements between the faculties of chemistry and geography and biology and geography (see Table 1).

## 5.2. Co-Borrowing Rules Based on Apriori Algorithm

### Group I

**Faculty of literature:** The association regulations for book borrowing are

**Table 1.** Repeated book borrowing among 10 departments.

Repeated borrowing of books (2013-2017)

	Geography	Law	Chemistry	Education	Human	Biology	Mathematics	Languages	Literature	Physics
Geography	37,188	5369	4864	7302	7082	5195	3417	7182	8991	4507
Law	5369	47,315	3547	6512	8096	3833	2055	6868	8952	2866
Chemistry	4846	3547	20,247	4695	4380	4129	2091	5197	6194	3081
Education	7302	6512	4695	78,677	11,846	4844	3176	10,925	17,952	4237
Human	7082	8096	4380	11,846	63,554	4685	2652	10,065	18212	3530
Biology	5195	3833	4129	4844	4685	21,070	2067	5276	6563	3020
Mathematics	3417	2055	2091	3176	2652	2067	16,831	2626	3330	2426
Languages	7182	6868	5197	10,925	10,065	5276	2626	53,257	19,504	3749
Literature	8991	8952	6194	17,952	18,212	6563	3330	19,504	116,412	4637
Physics	4507	2866	3081	4237	3530	3020	2426	3749	4637	20,280

Repeated borrowing of books (2018-2022)

	Geography	Law	Chemistry	Education	Human	Biology	Mathematics	Languages	Literature	Physics
Geography	14,701	1379	971	1318	1683	706	1177	1792	2662	855
Law	1379	31,203	1070	1573	2800	710	986	2411	3499	736
Chemistry	971	1070	8624	989	963	741	920	1450	2052	727
Education	1318	1573	989	37,464	3496	697	984	3322	6677	714
Human	1683	2800	963	3496	35,800	684	913	3460	7457	713
Biology	706	710	741	697	684	5983	529	1003	1365	411
Mathematics	1177	986	920	984	913	529	10,487	1220	1785	829
Languages	1792	2411	1450	3322	3460	1003	1220	31,333	9541	1000
Literature	2662	3499	2052	6677	7457	1365	1785	9541	80,436	1371
Physics	855	736	727	714	713	411	829	1000	1371	7232

highly reliable, with strong rule support. When the confidence criterion is 80%, the likelihood of co-borrowing is highest for I and K (support level of rule 61.21% from 2013 to 2017, 50.62% from 2018 to 2022), then I and H (support level of rule 55.58% from 2013 to 2017, 36.75 from 2018 to 2022), I and B (support level of rule 51.16% from 2013 to 2017, 39.8% from 2018 to 2022), I and G (support level of rule 46.72% from 2013 to 2017, 30.33% from 2018 to 2022), I and H and K (support level of rule 43.71% from 2013 to 2017, 26.25% from 2018 to 2022), and I and B and K (support level of rule 42.45% from 2013-2017, 31.6% from 2018 to 2022), and so on.

**Faculty of law:** The association regulations for book borrowing are highly reliable, with strong rule support. When the confidence criterion is 80%, the likelihood of co-borrowing is highest for DF and I (support level of rule 43.68% from 2013 to 2017, 29.44% from 2018 to 2022), then DF and D (support level of rule 32.4% from 2013 to 2017, 27.2% from 2018 to 2022), then DF and B (support level of rule 29.19% from 2013 to 2017, 23.22% from 2018 to 2022), DF and F (support level of rule 28.18% from 2013 to 2017, 21.36% from 2018 to 2022), DF and K (support level of rule 27.78% from 2013 to 2017, 19.12% from 2018 to 2022), and so on.

**Faculty of education:** The association regulations for book borrowing are highly reliable, with strong rule support. When the confidence criterion is 80%, the likelihood of co-borrowing is highest for G and I (support level of rule 55.2%) from 2013 to 2017, but this co-borrowing rule does not apply from 2018 to 2022. Rules of G and B (support level of rule 42.28% from 2013 to 2017, 29.71% from 2018 to 2022), G and B84 (support level of rule 40.73% from 2013 to 2017, 25.39% from 2018 to 2022), G and C (support level of rule 37.56% from 2013 to 2017, 26.02% from 2018 to 2022), and G and K (support level of rule 32.87% from 2013 to 2017, 18.49% from 2018 to 2022) have always been applicable.

**Faculty of human and social development:** When the confidence criterion is 80%, the likelihood of co-borrowing is highest for K and G (support level of rule 39.18% from 2013 to 2017, 28.44% from 2018 to 2022). Rules of K and D and I (support level of rule 39.02% from 2013 to 2017, 25.07% from 2018 to 2022), K and B (support level of rule 37.02% from 2013 to 2017, 25.37% from 2018 to 2022), K and G and I (support level of rule 33.76% from 2013 to 2017, 19.39% from 2018 to 2022), K and B and D (support level of rule 32.44% from 2013 to 2017, 18.74% from 2018 to 2022), and so on.

**Faculty of mathematics:** When the confidence criterion is 80%, the likelihood of co-borrowing is highest for O1-2 and T (support level of rule 30.47% from 2013 to 2017), but this co-borrowing rule does not apply from 2018 to 2022. Rules of O1-2 and H (support level of rule 18.55% from 2013 to 2017), O1-2 and K (support level of rule 18.04% from 2013 to 2017), and O1-2 and B (support level of rule 10.98% from 2013 to 2017) do not apply from 2018 to 2022.

Association rules for literature and history and literature and education have wide adaptability, followed by literature and language, literature and philosophy, and literature and language and history (see Figure 5). Similar regulations apply to co-borrowing books in Group II faculties as in literature faculties.

**Group II**

I and H (support level of rule 35.28%) have the highest probability of co-borrowing, followed by I and K books (support level of rule 27.98%), I and K and H (support level of rule 18.86%), I and G books (support level of rule 17.83%), and I and B (support level of rule 15.96%) in the borrowing records of readers from these four departments from 2013 to 2017. Only two co-borrowing rules, I and B (support level of rule 12.38%) and I and K and H (support level of rule 12.38%), had a confidence level of over 80% for the borrowing records of readers in these four departments from 2018 to 2022. Readers from these four departments enjoy borrowing language, history, and philosophy books when borrowing literary books.

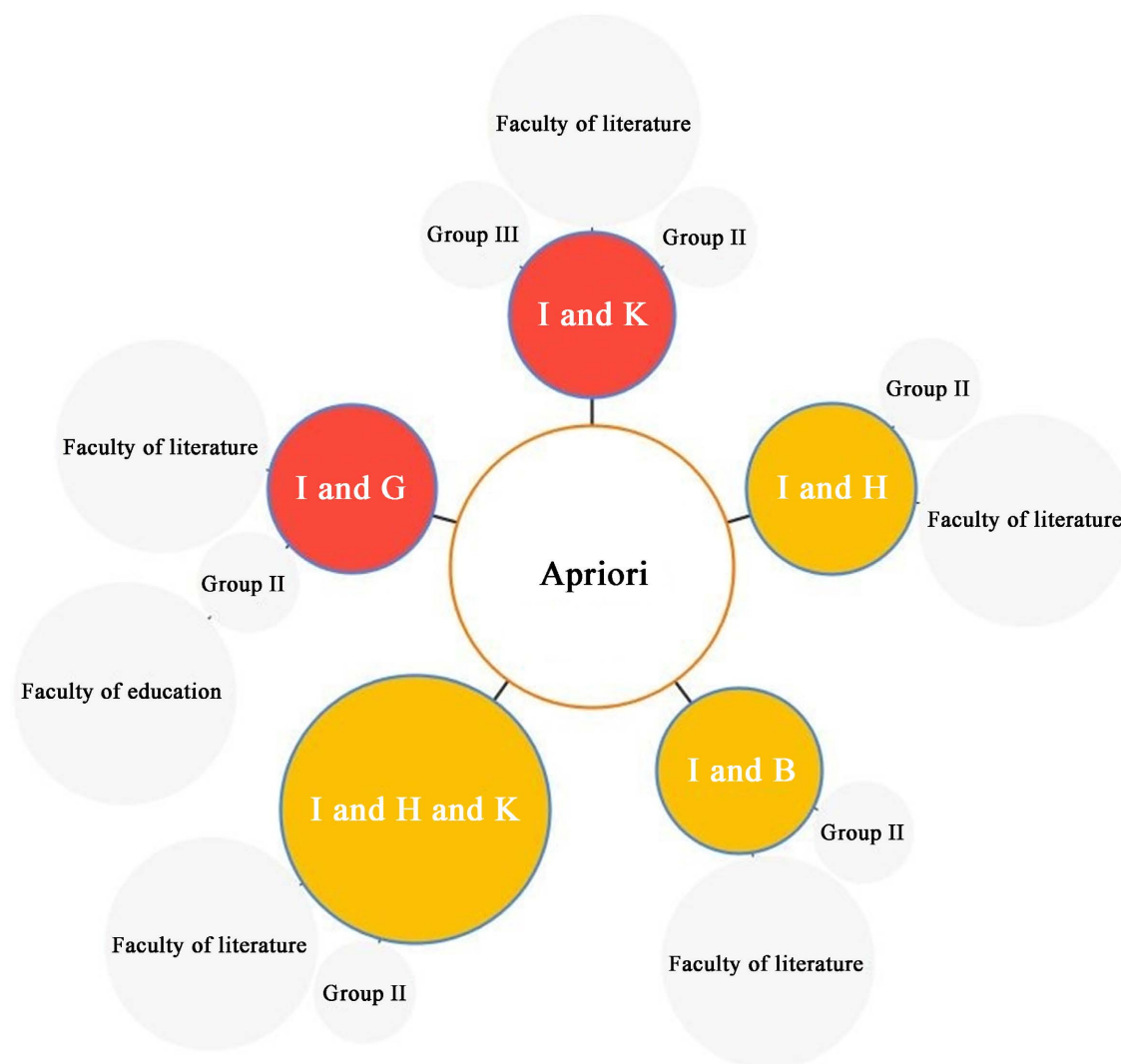


Figure 5. Important association rules.



### Group III

Between 2018 and 2022, no association rules are discovered when the confidence criterion is 80%. The rules of the I and K (support level of rule 12.17%) and the O3-5 and O1-2 and T (support level of rule 8.35%) are found when the confidence criterion is 70%. I and K (support level of rule 20.2%), O3-5 and O1-2 and T (support level of rule 15.19%) are the other two rules that are also in effect from 2013 to 2017. Low support means that rules with higher confidence from 2013 to 2017—such as T and O1-2 (rule support level: 21.66%), I and H (rule support level: 18.68%), T and H (rule support level: 18.24%), and T and K (rule support level: 18.02%)—will not be applicable from 2018 to 2022. Readers from the faculty of physics enjoy co-borrowing literary and history books, as well as physical, mathematical, and technical books.

### 5.3. Analysis of Several Types of Book Borrowing Using Linear Regression

Given the faculties of literature ( $X_1$ ), education ( $X_2$ ), law ( $X_3$ ), human and social development ( $X_4$ ), mathematics ( $X_5$ ), foreign languages ( $X_6$ ), chemistry ( $X_7$ ), geography ( $X_8$ ), biology ( $X_9$ ), and physics ( $X_{10}$ ).

#### I. Equation of linear regression for the I (literature) book:

$$\begin{aligned} 2013-2017: \quad Y = & -5.025E-13 + 0.586X_1 + 0.307X_6 + 0.200X_2 + 0.169X_4 + 0.149X_8 \\ & + 0.130X_3 + 0.126X_7 + 0.126X_9 + 0.095X_{10} + 0.072X_5 \end{aligned}$$

$$\begin{aligned} 2018-2022: \quad Y = & -7.568E-13 + 0.748X_1 + 0.394X_6 + 0.198X_2 + 0.169X_4 + 0.143X_3 \\ & + 0.143X_7 + 0.142X_8 + 0.117X_5 + 0.105X_9 + 0.101X_{10} \end{aligned}$$

#### II. Equation of linear regression for the G (education) book:

$$2013-2017: \quad Y = -8.475E-13 + 0.963X_2 + 0.319X_1 + 0.231X_4 + \dots$$

$$2018-2022: \quad Y = 2.160E-12 + 0.968X_2 + 0.425X_1 + 0.316X_4 + \dots$$

#### III. Equation of linear regression for the DF (law) book:

$$2013-2017: \quad Y = 2.416E-12 + 0.957X_3 + 0.119X_2 + 0.095X_4 + \dots$$

$$2018-2022: \quad Y = 8.925E-13 + 0.972X_3 + 0.116X_4 + 0.091X_1 + \dots$$

#### IV. Equation of linear regression for the K (history) book:

$$2013-2017: \quad Y = 1.244E-12 + 0.603X_4 + 0.556X_1 + 0.281X_6 + 0.246X_2 + \dots$$

$$2018-2022: \quad Y = 2.220E-16 + 0.453X_4 + 0.313X_1 + 0.073X_6 + 0.047X_2 + \dots$$

#### V. Equation of linear regression for the Q1-2 (math) book:

$$2013-2017: \quad Y = 3.168E-14 + 0.847X_5 + 0.318X_{10} + 0.281X_8 + 0.222X_7 + 0.217X_9 + \dots$$

$$2018-2022: \quad Y = 3.848E-13 + 0.957X_5 + 0.260X_8 + 0.239X_7 + 0.236X_{10} + 0.150X_2 + \dots$$

#### VI. Equation of linear regression for the Q3-5 (physics) book:

$$2013-2017: \quad Y = 8.799E-14 + 0.934X_{10} + 0.276X_9 + 0.263X_7 + 0.253X_5 + 0.204X_8 + \dots$$

$$2018-2022: \quad Y = 2.038E-14 + 0.988X_{10} + 0.345X_5 + 0.307X_7 + 0.204X_8 + 0.194X_9 + \dots$$

#### VII. Equation of linear regression for the T (technology) book:

$$2013-2017: Y = 1.231E - 13 + 0.606X_8 + 0.563X_{10} + 0.390X_2 + \dots$$

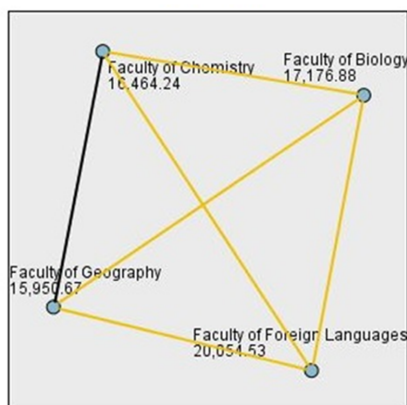
$$2018-2022: Y = -1.025E - 13 + 0.733X_8 + 0.526X_{10} + 0.471X_5 + \dots$$

The adjusted R square of the aforementioned seven equations is all 1, indicating that there is a definite linear link between the frequency of book borrowing and the 10 departmental parameters.

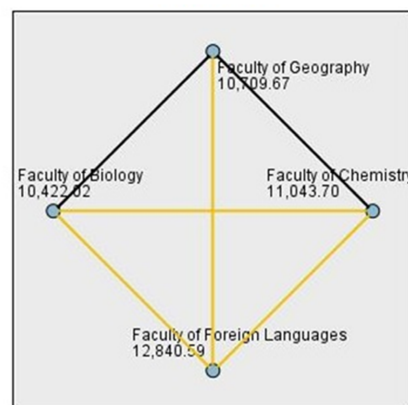
### 5.4. Literary Book Borrowing in Group II

The volume of literary book borrowing varies throughout the four departments. There were significant differences in all other categories in the paired comparison between 2013 and 2017, with the exception of the chemistry and geography groups. All categories had significant differences between 2018 and 2022, with the exception of the chemistry and geography group and the biology and geography group. The faculty of foreign languages has the highest average borrowing rate per literary book, while from 2013 to 2017, it was lowest in the faculty of geography, and from 2018 to 2022, it was lowest in the faculty of biology (see **Figure 6**). While the average borrowing rate of each literary book in the faculty

Pairwise Comparisons of Department  
2013-2017



Pairwise Comparisons of Department  
2018-2022



Borrowing of literature books (2013-2017)

Department	Mean	N	Std. Deviation
Faculty of Biology	1.35	7599	0.774
Faculty of Chemistry	1.29	3475	0.724
Faculty of Foreign Languages	1.79	22737	1.465
Faculty of Geography	1.25	3662	0.719
Total	1.60	37473	1.256

Borrowing of literature books (2018-2022)

Department	Mean	N	Std. Deviation
Faculty of Biology	1.20	2283	0.581
Faculty of Chemistry	1.29	3475	0.724
Faculty of Foreign Languages	1.66	14633	1.307
Faculty of Geography	1.25	3662	0.719
Total	1.50	24053	1.125

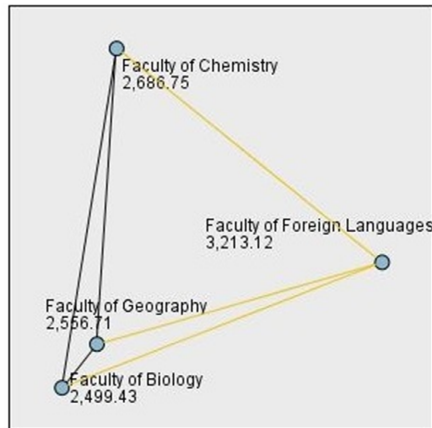
**Figure 6.** The Kruskal-Wallis test results of the volume of literary book borrowing in Group II.

of biology is trending downward, the average borrowing rate in the faculty of geography remains unchanged. Overall, there is a downward trend.

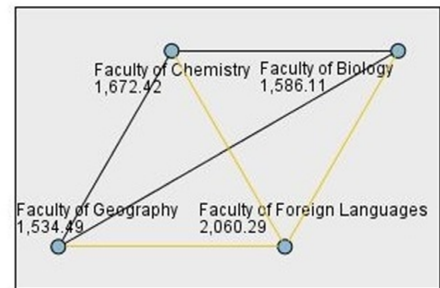
The volume of literature borrowed personally varies throughout the four departments. The pairing of foreign languages with biology, chemistry, and geography differs significantly in the paired comparison, whether it is from 2013 to 2017 or from 2018 to 2022. The pairing of biology, chemistry, and geography shows no differences (see **Figure 7**). The faculty of foreign languages has the greatest per capita borrowing volume, whereas the lowest per capita borrowing volume from 2013 to 2017 was in the faculty of biology and from 2018 to 2022 in the faculty of geography. There is a general declining tendency.

There are significant differences in preferences for literary books among the four departments. When using departments as node data, borrowing books matching departments as edge data, and Fruchterman Reingold for Gephi layout, we have discovered that the top ten books borrowed by each department

Pairwise Comparisons of department 2013-2017



Pairwise Comparisons of department 2018-2022



Borrowing of literature borrowers (2013-2017)

Department	Mean	N	Std. Deviation
Faculty of Biology	9.65	1066	18.148
Faculty of Chemistry	11.27	883	17.317
Faculty of Foreign Languages	17.43	2331	26.720
Faculty of Geography	9.86	1391	17.267
Total	13.15	5671	22.091

Borrowing of literature borrowers (2018-2022)

Department	Mean	N	Std. Deviation
Faculty of Biology	6.55	419	9.796
Faculty of Chemistry	8.11	553	18.858
Faculty of Foreign Languages	12.62	1927	19.798
Faculty of Geography	5.90	774	8.086
Total	9.83	3673	17.110

**Figure 7.** The Kruskal-Wallis test results of the volume of literature borrowed personally in Group II.

do not overlap, while the top 100 books have very little overlap; the overlap area between the top 300 books and the top 500 books is relatively large; the intersection between the faculty of geography, biology, and chemistry is relatively large; and the intersection between the faculty of foreign languages is relatively small (see **Figure 8**).

### 5.5. Changes in the Most Borrowed Books in Group III

The physics faculty's most often borrowed books between 2013 and 2017 were T (technique) books and I (literary) books between 2018 and 2022. Regarding the most popular technical books in the physics department, there is a 20% overlap with the mathematics department, a 10% - 14% overlap with the geography department, and a 2% - 10% overlap with the chemistry department. Regarding the most popular literary works in the physics department, there is a 65% overlap with the literature department, a 40% overlap with the foreign language department, a 40% overlap with the chemistry department, and a 40% overlap with the law department (see **Table 2**).

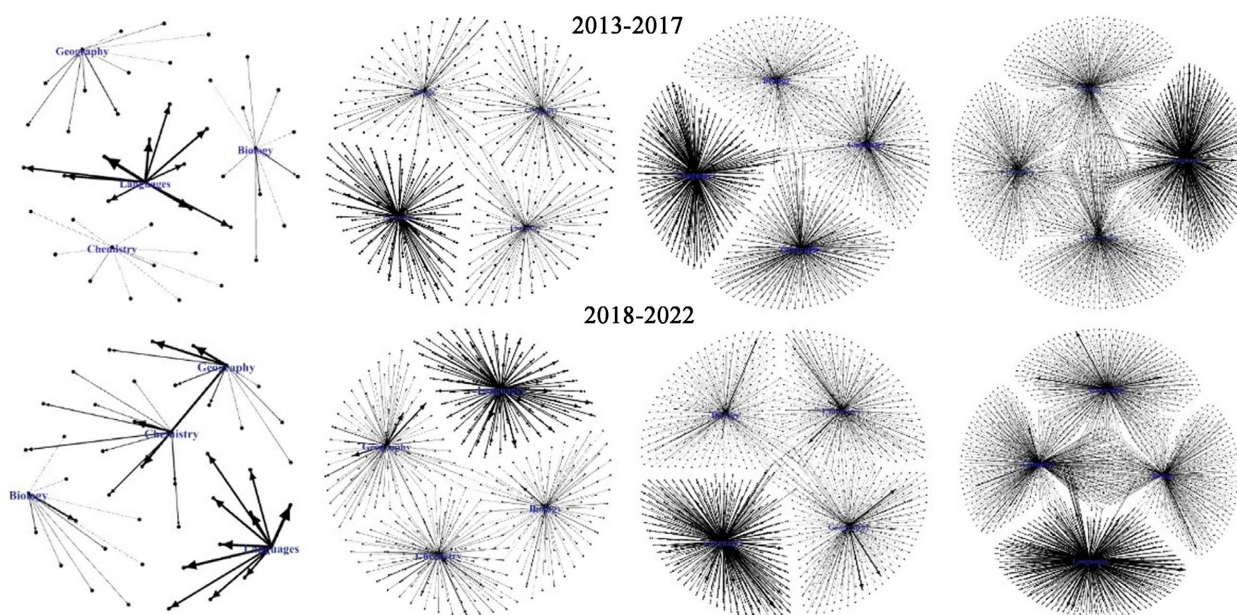
### 5.6. Distribution of Readers' Borrowing Volume

#### Group I

The distribution of the I book borrowed by the faculty of literature, the G book borrowed by the faculty of education, the DF book borrowed by the faculty of law, the K book borrowed by the faculty of human and social development, and the O1-2 book borrowed by the faculty of mathematics for the years 2013-2017 and 2018-2022 all follow the Pareto principle (see **Figure 9**).

#### Group II

For the years 2013-2017 and 2018-2022, the distribution of literary book



**Figure 8.** Overlap of literary books borrowed by four departments in 2013-2017 and 2018-2022.

**Table 2.** Co-borrowing of the most popular books in the faculty of physics.

T book 2013-2017			
Faculty	∩ Faculty	Top 10 (%)	Top 100 (%)
Physics	∩ Physics	10 (100%)	100 (100%)
	∩ Mathematics	2 (20%)	21 (21%)
	∩ Geography	1 (10%)	14 (14%)
	∩ Chemistry	1 (10%)	2 (2%)
	∩ Education	0	4 (4%)
	∩ Human and Social Development	0	1 (1%)
	∩ Literature	0	1 (1%)
	∩ Biology	0	1 (1%)
	∩ Foreign Languages	0	0
∩ Law	0	0	
I book 2018-2022			
Faculty	∩ Faculty	Top 10 (%)	Top 100 (%)
Physics	∩ Physics	10 (100%)	100 (100%)
	∩ Literature	6 (60%)	65 (65%)
	∩ Foreign Languages	4 (40%)	38 (38%)
	∩ Chemistry	4 (40%)	36 (36%)
	∩ Law	4 (40%)	34 (34%)
	∩ Education	3 (30%)	34 (34%)
	∩ Geography	3 (30%)	30 (30%)
	∩ Biology	2 (20%)	25 (25%)
	∩ Mathematics	2 (20%)	24 (24%)
	∩ Human and Social Development	2 (20%)	17 (17%)

borrowing among the four departments in Group II follows the Pareto principle. A select group of literature lovers from the four departments makes most of the decisions about the borrowing of literary works (see **Figure 10**).

### Group III

The T book borrowed during 2013-2017 and the I book borrowed during 2018-2022 by the faculty of physics' distribution also follow the Pareto principle (see **Figure 11**).

## 6. Discussion

### 6.1. Department Portrait

Nanjing is known as the city of literature. The library patrons of NNU are portrayed as literary youth. Readers at NNU typically have a literary bent because

the number of borrowed literary works is either the highest or second-highest among the 10 departments. The faculties in Groups II and III, as well as the literature faculty, all uphold and hold in the highest regard the association rule of

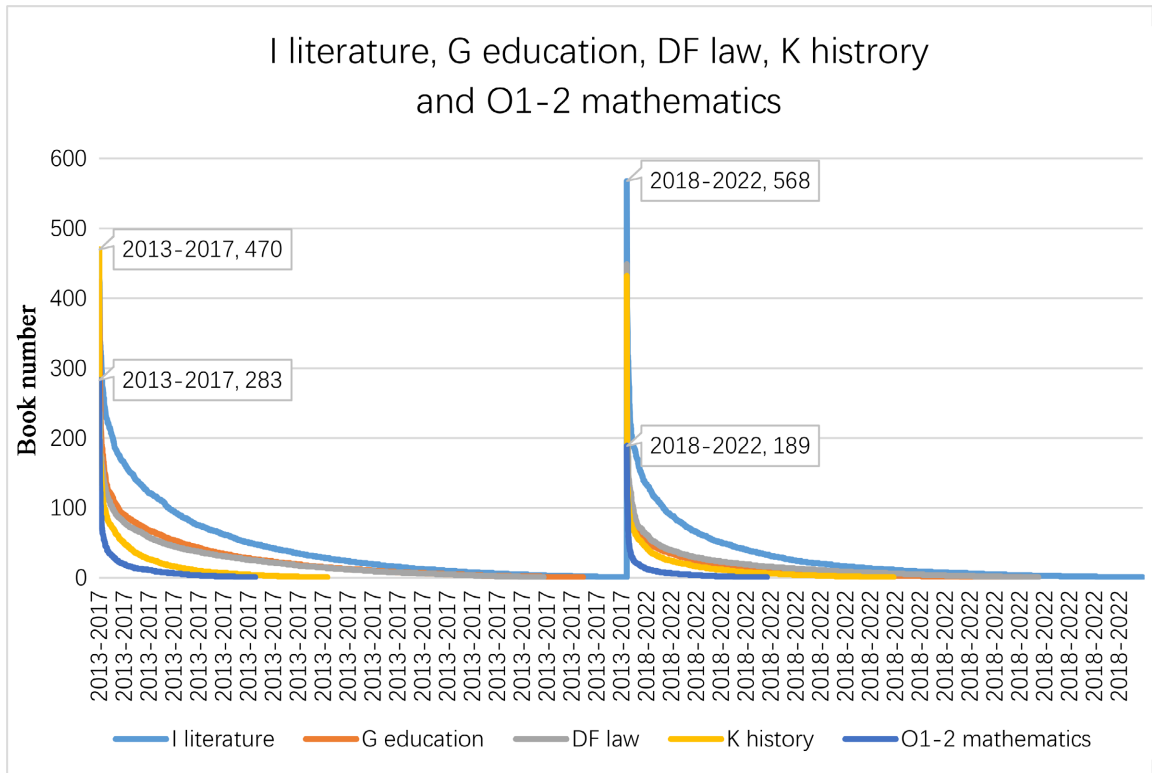


Figure 9. The distribution of the I, G, DF, K and O1-2 book borrowing in Group I.

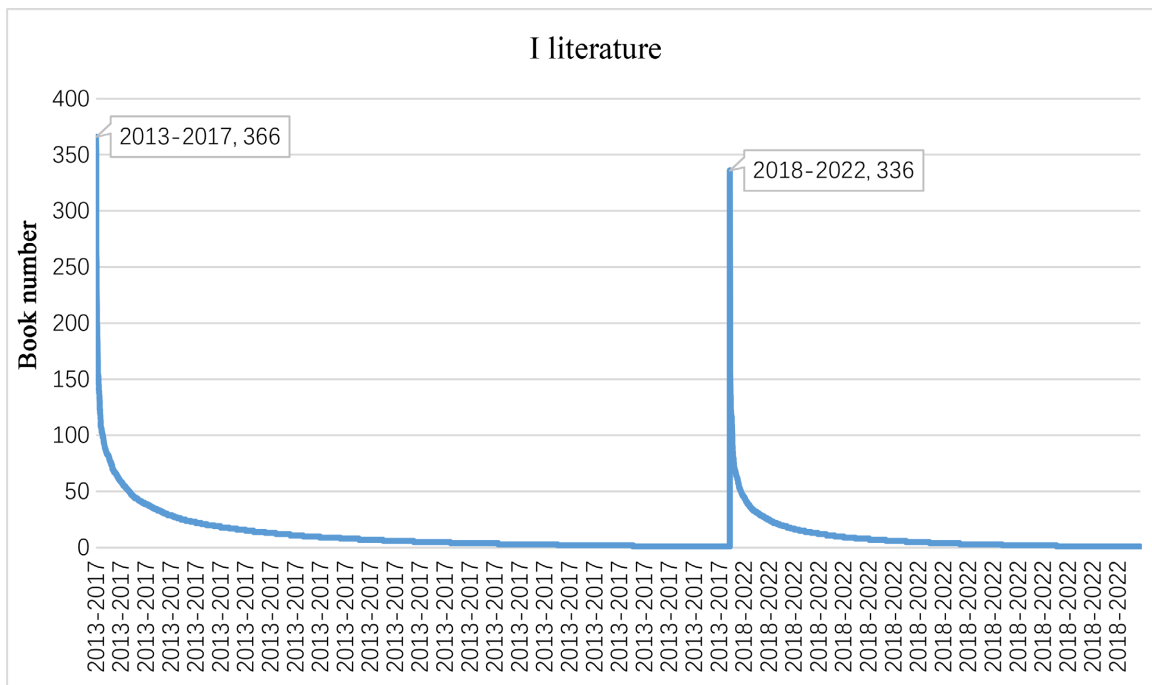
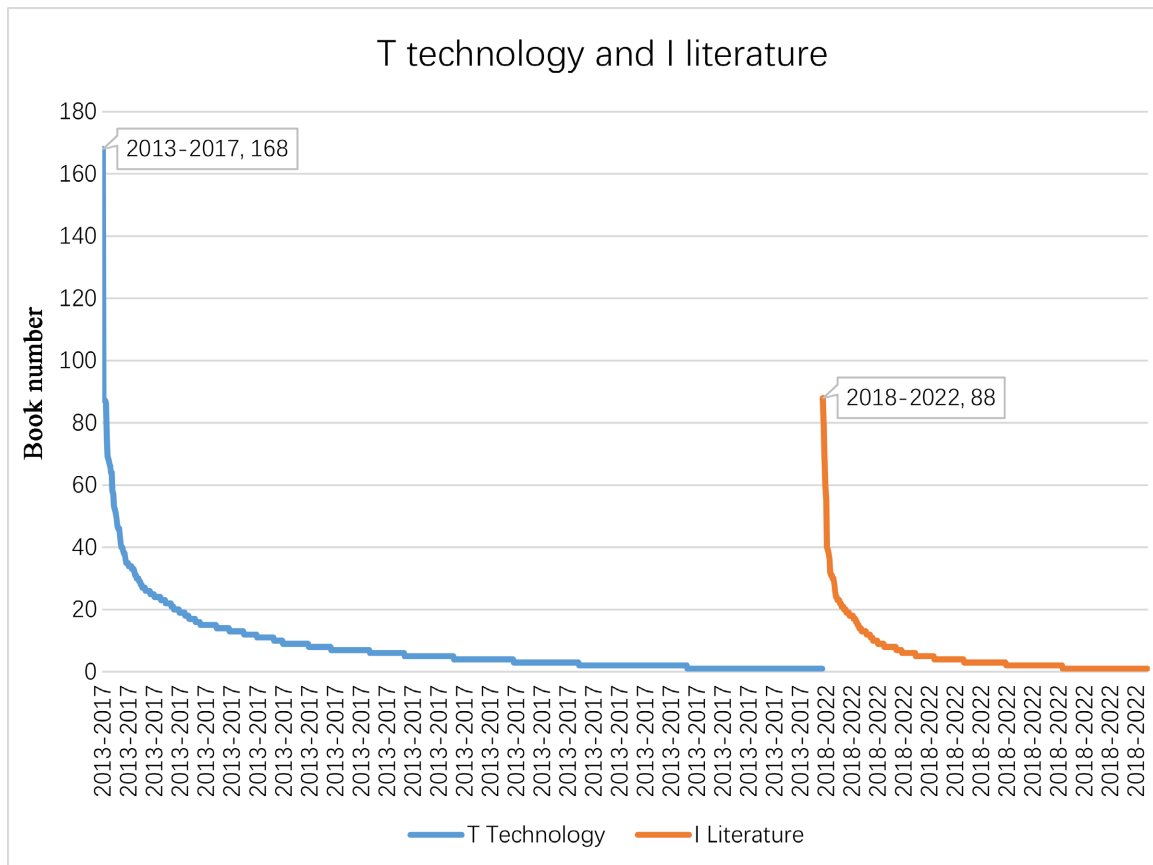


Figure 10. The distribution of the I book borrowing in Group II.





**Figure 11.** The distribution of the T and I book borrowing in Group III.

literature and history. Borrowers from the literature and foreign language faculties have a high affinity for borrowing books. The NNU library has a high share value for the books that patrons from the two departments have checked out. Although literary books are the most frequently borrowed, faculties in Group II have diverse choices for literary books. There is no overlap in the top 10 books borrowed by each department, either before or after the pandemic. Sharing popularly borrowed literary works among these four categories has no real relevance.

Literature and history have always been intertwined since the dawn of time, and this intimate link is also referred to as the connection or the homology between literature and history in China. Legends have been transmitted through their distinctive literary and artistic forms. Readers can see the hue of literature in early myths and stories. The social style of the work at that time can be partially restored by removing elements that require excessive creation and exaggeration through the characters and plots of literary works. Ancient poetry and literature all had the same practical purposes, including imparting the Tao through literature and expressing one's hopes and emotions through poetry. People who read literary works frequently obtain a comprehensive and vivid understanding of social history and existence, as well as an improvement in their capacity to notice and comprehend life. Additionally, since literature possesses both artistic



and historical qualities, it can be skillfully incorporated into tracing the history of disciplines to broaden the sources of historical information, develop students' skills in analyzing historical evidence, and deepen their understanding of the past.

Discussions about the importance of the arts and humanities frequently center on these fields' capacity to provide such results and draw attention to their function in fostering direct skill development and bringing financial benefits to both individuals and society as a whole. Artificial dichotomies between vocational and academic aims as well as developmental and instrumental endeavors can occasionally get in the way of discussions of the social and economic significance of the arts and humanities to come up with analytical conclusions on their importance to the economy and society, such as how they might improve graduates' lives and social advancement (Ashton et al., 2023). On the one hand, work-integrated learning is frequently credited with playing a key role in providing recent graduates with the employability skills they need to thrive in the workplace. What students actually experience during placement or what they believe is significant to their learning should broadly accord with standards for work-integrated learning (Jackson, 2015). On the other hand, universities have come under increasing pressure in recent years to add an ambiguous third mission known as "a contribution to society" in addition to their primary missions of doing research and teaching and connected to the social and economic mission of universities (Compagnucci & Spigarelli, 2021). Since the latter half of the 20<sup>th</sup> century, citizen science has gained popularity as a catchall term for an expanding variety of participatory research projects. The citizen science discourse's contemporary promises-democratization, education, and discoveries-critically place some historical, political, and social issues within the broader history of public participation in science (Strasser et al., 2019).

In terms of the actual facilitation of philosophical discussion, it is generally believed that this is both an interesting and challenging task for teachers. The lecturers have emphasized that flexibility in terms of allowing the discourse to go in any direction is one of the key facilitation abilities. Teachers consider communication to be another crucial ability (Jensen, 2020). The independence of teachers in their careers and the mismatch between their goals and the abilities needed to teach in the twenty-first century, their mastery of the curriculum, their comprehension of the assessments, and their motivation to participate in educational change all have an impact (Amponsah, Ampadu, & Thomas, 2023).

## 6.2. Professional Solidification

The construction of departments in universities and the development of specialized talents both depend on discipline. The symbol of CLC adopts a mixed number of SASM/GNC romanization and Arabic numerals. Using a letter to represent a large category, reflecting the sequence of the categories in alphabeti-

cal order. Using numbers after letters to indicate the division of categories below the major categories. When users don't have a single resource in mind, they navigate bibliographic families top-down, prioritizing the most significant subject idea (Arastoopoor, 2022). It is simpler to find information again when professors put an emphasis on academic memory. Information can be remembered more readily when it is categorized (Nwagwu & Donkor, 2022). Readers can define source credibility in terms of authority and trustworthiness and content soundness in terms of plausibility and empirical evidence thanks to conceptual analysis in the context of a particular subject (Vamanu & Zak, 2022). The semantic web of the digital library allows for personalization and produces appropriate book recommendations (Shahzad & Khan, 2022). Under this assumption, readers already know what they want to read, and ultimately, relevance is what makes a book appealing to them.

Although a department's reading list is frequently updated by teachers and students, the increase in the coefficients of the main influencing elements of numerous linear equations during the epidemic demonstrates the strengthening of subject reading. Typically, the department that corresponds to the book classification discipline is the main contributing element. The effect coefficient in the linear equation greater than 0.95 indicates that there is a particularly strong concentration impact of key departments on borrowing books in mathematics, physics, education, and law, which reflects the discipline setting logic and library classification systems being compatible.

Subject librarians' major responsibility is to function as a liaison between the library and the relevant departments, offering proactive and comprehensive literary information services for both teaching and research. The subject librarians' professional knowledge structure system, which includes the basic knowledge layer, professional knowledge layer, and dynamic knowledge layer, should be at least as good as or better than that of outstanding undergraduate graduates in the corresponding professional disciplines.

### **6.3. Interdisciplinary Expansion**

Researchers struggle to keep up with multidisciplinary growth as they work to categorize and rearrange current information in order to establish new branches of disciplines. One problem with book cataloging is the collocation categorization of works with transdisciplinary themes, like those with three subject areas. Book sorting is influenced by librarians' individual understanding of cataloging rules, library usage requirements, and technological advancements (Nwagwu & Donkor, 2022), even though it is based on CLC.

Books categorized under a particular discipline alphabet also draw readers from outside of their local sector. Literature and history books have the greatest appeal readers of the NNU library. Although the reading population of literature in society is declining, there are fewer students majoring in literature in colleges and universities due to the ongoing digital revolution and pressures from STEM

(science, technology, engineering, and mathematics) subjects (Gu, 2018). Finding out about the new rules for reader co-loans of books is not difficult. To the fullest degree of assurance and support, the rule of professional and I is applied to the departments of law (DF and I) and education (G and I). The highest level of assurance and support is given to the rule of professional and other categories besides I by the faculties of mathematics (O1-2 and T) and human and social development (K and G) in Group I.

It is hard to ignore the impact of students' informal intellectual interactions and classroom dynamics. According to their use and relevance, users from various academic departments or majors use various information sources (Kim, 2011), and pedagogical information need not always be discipline-based in higher education (Young, 2010). University students are encouraged to read across disciplines for a variety of reasons, including the enjoyment of reading and the potential to connect with others who share their enthusiasm (Martens, Balling, & Higgason, 2022). Compared to the average individual, creative people have a broader education, more extracurricular interests, and greater aptitude in these pursuits. The hobbies of the most successful professionals in STEM fields are unusually likely to include fine arts like painting or music, literary accomplishments, or crafts like woodworking and metalworking, mechanics, and electronics (Root-Bernstein, 2015). In contrast to reading nonfiction, popular fiction, or doing nothing at all, reading literary fiction resulted in temporarily improved performance on tests of affective and cognitive abilities for understanding other people's mental states, which is a critical ability that supports the intricate social interactions that define human cultures (Kidd & Castano, 2013).

Transdisciplinary thinking does not disregard disciplinary thought while promoting integration. On the one hand, spanning disciplines is beneficial since it enables scientists to identify connections between domains, and merging different fields has a favorable impact on the generation of knowledge. On the other hand, it is a high-risk, high-reward endeavor that relies in part on interdisciplinary collaboration at the professional level (Leahey, Beckman, & Stanko, 2017). Even when the quantity of partners, the principal study area, and the type of institution are taken into account, interdisciplinarity still has a detrimental influence. The likelihood of receiving funding decreases as interdisciplinarity increases (Bromham, Dinnage, & Hua, 2016). Successful research is better performed through research efforts that draw on a reasonably close range of fields, as distal interdisciplinary studies could be too hazardous and more likely to fail. Heterodox articles that combine very different fields of knowledge are less likely to be cited by scientific audiences (Yegros-Yegros, Rafols, & D'Este, 2015).

#### 6.4. Weigh Options

Regardless of their subject matter, priority borrowing status with correspondent or non-correspondent departments, priority borrowing status before or during

the epidemic, or whether they are professional, literary, or other types of books, the books with the highest borrowing volume in each department all adhere to the Pareto principle. 80% of borrowings come from the general 20% of faculties. The uneven readership of books has posed a challenge to our traditional linear thinking, and when investing in the development of topical resources, we should concentrate more on these 20% efficient readers than on distributing resources equally. Of course, the long tail idea, which goes against the Pareto principle, encourages focusing on the demand of the final 80% of the exponential distribution when the cost of the book is low. The readers with low demand will accumulate a large amount of borrowing, even more than 20% of the readers in the general population. Teaching staff in Groups II and III could extend teacher-student topics on topics that 20% of literary enthusiasts are interested in in addition to professional teaching, while teaching staff in Group I could concentrate on the reading interests of 20% of high borrowers of professional books.

Teacher leadership centered on roles beyond the classroom, including supporting peers' professional development, influencing policy and decision-making, and ultimately focusing on student learning (Wenner & Campbell, 2017). Teachers are an essential provider of information for students who have suffered from a disadvantage (Gershenson, Holt, & Papageorge, 2016). Firstly, academics should collaborate, explore how to reinvent their own disciplines, and learn to grasp the multicultural perspective and epistemology of sustainability, both as a topic and as an area of education research, in order to improve sustainability in the curricula (Leal Filho et al., 2018). Secondly, in higher education, there are different contexts where student involvement occurs, such as in the classroom, in relation to a specific work or assignment, and inside and across the course or program of study. Adopting context-specific approaches can assist students and staff in effectively navigating co-creation of learning and teaching.

The association between good emotions and academic performance is mediated by academic psychological capital and academic engagement (Carmona-Halty et al., 2021). In addition to collaborating on course content and learning and teaching processes, faculty and students may also do disciplinary research, design assessments like essay questions or select from a variety of assessment strategies, and grade their own and others' work (Bovill et al., 2016). A certain level of novelty and curiosity might boost students' learning motivations. Math achievement benefits only slightly to moderately from music interventions. A significantly strong and positive transfer in math learning only happens when math and music are employed together in the learning setting (Akin, 2023). Furthermore, teachers should investigate the interdisciplinary knowledge material found in real-life scenarios if the teaching content of STEM interdisciplinary thematic learning courses is based on real-life difficulties.

## 7. Limitations

This study only sheds light on university lecturers' and students' reading habits

from the perspective of library borrowing statistics because the intersection and integration of disciplines are complicated phenomena. The current study's data scope or conditions are restricted to the library of Nanjing Normal University, and its findings might not generalize to other academic institutions. Data mining rules are descriptive, and because they are based on hindsight, even though they are objective standards, they cannot account for every borrowing by readers. It is also required to take into account a wider range of application scenarios, conduct pertinent case studies, expand sample sizes, use multiple data sources, etc. in order to thoroughly examine this topic.

## 8. Conclusion

In teacher education, the monotonous training and indoctrination of teaching techniques and skills that are divorced from students' lives and reality frequently ignore individuals' true-life circumstances and the forces that are driving both external and internal teacher professional development. The study of science and engineering majors mainly focuses on experimental research, and the knowledge learned can be directly and quickly applied to experimental research, thereby promoting the improvement of one's own abilities and making it easier for students to feel the progress of their own growth. However, the practicality and operability of the content learned by normal students majoring in social sciences are weak. The findings of this study can help with multidisciplinary collaboration, subject librarian consulting services, course teacher curriculum design, and education and teaching authority planning projects.

Warmth and love are needed in the teaching profession. Teachers can only give students significant and potent sustenance and direction if they have a solid foundation, broad vision, and a calm and farsighted mindset. Ideological emancipation frequently drives the advancement of science and technology, and the ideological liberation movement coexists with the establishment of scientific hubs, like the Italian Renaissance, the British Religious Revolution, the French Enlightenment and Political Revolution, the German Philosophical Changes, and the American Ideological Liberation and Technological Innovation. Many scientific spirits are essential, including the spirit of inquiry, skepticism, and critique. The core of a teacher's humanistic literacy is their humanistic knowledge, which influences not just their own spiritual lives, but also how students' spiritual worlds are built. Therefore, it is important to focus on integrating academic learning with normal students' professional experiences to strengthen the connections between academic learning and hands-on learning outside of the classroom and focus explicitly on how training periods at universities and work experience are organized in time (Escalié et al., 2023). Since objective reality is the subject of scientific inquiry, it encourages people to seek the truth. People, the subjective world, and the pursuit of virtue are the subjects of humanistic inquiry. Science and technology can maintain their proper focus and improve the welfare of human civilization when they are guided by a humanistic mentality.

The understandings, abilities, and attitudes required to interpret information and apply it to improve work or learning processes are referred to as student feedback literacy. Teachers are recognized as playing significant enabling roles in fostering student feedback literacy through the design of curricula, direction, and coaching (Carless & Boud, 2018). Peer feedback and exemplar analysis could be redirected more specifically towards helping students increase their feedback literacy (Carless & Boud, 2018). In the classroom, a teacher's enthusiasm spreads and has a beneficial impact on students' emotions. They have a crucial influence on how students engage. The association between perceptions of teacher excitement and student social-behavioral engagement is found to be co-mediated by student delight and boredom (Dewaele & Li, 2021).

Technology has ingrained itself into everyday life and is increasingly influencing schooling. It becomes nearly inevitable that traditional and digital classrooms will merge. Based on their own perceptions of their technological proficiency, teachers chose certain technologies (Escalié et al., 2023). Bridging the gap between training and research is still a challenge since students frequently struggle to relate their classroom experiences to the intellectual knowledge they have learned in school. Although the use of computers can improve educational quality, technology cannot stand alone. The main difficulties come from establishing the effective application of the advantages offered by digital technology (Singh, 2021). Although digital tools are essential to how students experience their studies, they are not fundamentally altering the nature of university teaching and learning. Therefore, university educators may need to curb their enthusiasm for the potential outcomes of technology-enhanced learning and have a deeper comprehension of the realities of students' interactions with data mining technology (Henderson, Selwyn, & Aston, 2017).

### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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