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# Reading of humanities and social sciences books in chemistry, mathematics, and physics majors

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**ABSTRACT:** *This study analyzes book borrowing patterns among 4,403 borrowers from the chemistry, mathematics, and physics departments at the library of Nanjing Normal University from 2014 to 2023. Utilizing the Chinese Library Classification System, the researcher calculated and ranked the borrowing volumes of various book categories, aiming to discern correlations among multiple variables. Data was processed in SPSS, employing nonparametric tests and correspondence analysis to examine the relationship between book categories and departmental borrowing patterns. Moreover, the researcher calculated the annual borrowing averages for liberal arts books, visualizing trends through scatter plots in Excel to forecast borrowing behavior for 2024. Utilizing Gephi, network diagrams of borrowing relationships were constructed to evaluate connectivity among readers within each department. Further analysis through SPSS involved refining book classifications and performing factor analysis, while structural equation modeling in AMOSS allowed for the calculation of correlation and covariance coefficients between observed and latent variables. The findings provide insights into the humanities and social sciences books' borrowing habits of students in these scientific majors, revealing patterns that could inform library resource allocation and academic support.*

***Key words****: Chemistry, Gephi, Humanities and social sciences (HSS), Mathematics, Physics, SPSS.*

## 1. Introduction

In a rapidly changing world marked by technological complexity, there is an increasing recognition of the need for educational frameworks that move beyond a purely technocentric focus. The historical context surrounding technological disasters has prompted a critical reevaluation of education, underscoring the importance of integrating HSS (humanities and social sciences) insights into curricula. This multidisciplinary approach addresses contemporary challenges and prepares students for an interconnected society (Roby, 2024). In this context, the growing interest in combining HSS with STEM (science, technology, engineering, and mathematics) reflects a broader understanding of these perspectives' value to education (Scholkmann et al., 2023).

The emotional challenges individuals face within various social roles highlight the importance of nurturing a sense of purpose and belonging through education, further emphasizing the need for a comprehensive approach to teaching that encompasses emotional well-being (George et al., 2023). Understanding the relationship between individual roles and their broader implications is paramount in an increasingly complex societal landscape. With a defined role, individuals may be able to find meaning in their work and lives; however, misalignment can lead to frustration and feelings of loneliness, as socioeconomic changes add further pressure on one's sense of security. Humanities scholars have a crucial part to play in addressing the lived experiences of despair, emphasizing the need for interventions that target the root causes rather than merely the downstream consequences, such as diseases and deaths stemming from distress (George et al., 2023). Integrating HSS into educational curricula enhances understanding of science and technology as human constructs intertwined with historical and sociopolitical contexts (Roby, 2024). This approach fosters a critical mindset among learners and promotes a more nuanced understanding of societal challenges. Early



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HSS education is essential for developing informed citizens tackling complex social, economic, and ecological issues (Deehan, H. & Deehan, J., 2024). By employing interdisciplinary and cross-curricular pedagogies, educators can facilitate holistic learning experiences that resonate with real-life contexts, ultimately preparing students to address the complexities of human knowledge and societal challenges (Cohen et al., 2024).

The education landscape is dynamically evolving to meet the demands of a rapidly changing world. This prompts a shift from conventional STEM (science, technology, engineering, and mathematics) education to a more encompassing approach known as STEAM (science, technology, engineering, arts, and mathematics). This evolution acknowledges the importance of integrating arts, humanities, and social sciences into the STEM curriculum, fostering technical skills, creativity, and self-expression. As nations across the globe, including the United States, Canada, Europe, Australia, and parts of Asia, increasingly recognize the value of STEAM education, there is a pressing need for comprehensive research into the assessment and enhancement of STEAM competence, mainly through statistical methodologies and surveys (Chen & Ding, 2024). However, incorporating HSS into STEM education has ignited significant debates regarding its perceived role within educational curricula. Critics argue against the viewpoint of HSS integration as an inconsequential "add-on," emphasizing that this narrow perception undermines HSS's profound, transformative potential in enriching STEM education (Scholkmann et al., 2023). The failure to adequately embed HSS deprives students of essential soft skills, such as critical thinking, effective communication, and teamwork, which are vital for navigating the complexities of the 21st century. Additionally, many educational policies often disregard the necessity of quality arts processes and experiences at every educational level, limiting the potential for a holistic educational approach (Chen & Ding, 2024). While interdisciplinary collaboration between HSS and engineering disciplines holds promise for enriching educational practices, it also encounters significant challenges, such as institutional silos that prioritize technical knowledge over broader humanistic insights (Scholkmann et al., 2023). The disparate epistemological foundations of HSS and engineering further complicate this integration as each field approaches knowledge and problem-solving from significantly different perspectives. The limited scope of current research, characterized by inadequate sample sizes and variability, highlights the urgency for future studies that can comprehensively capture students' and educators' diverse educational needs (Chen & Ding, 2024). By addressing these challenges and recognizing the vital role of HSS within STEM education, we can pave the way for a more integrated and enriched educational framework that fosters both technical proficiency and creative thinking.

Exploring the reading habits of teachers and students in chemistry, mathematics, and physics, particularly their engagement with humanities and social sciences literature, is of significant importance. Understanding these habits can illuminate how educators and students interact with the broader context of their studies, encouraging interdisciplinary connections that enrich the learning experience. Teachers play a crucial role in modeling reading behaviors for their students. Their engagement with literature beyond their primary discipline can influence young learners to appreciate the value of diverse perspectives. This is especially pertinent in STEM fields, where integrating humanities and social sciences can foster critical thinking and creativity. Exposure to materials outside their core subjects can enhance students' analytical skills and broaden their understanding of real-world applications. Engaging with humanities literature can deepen students' understanding of the ethical implications, societal impacts, and historical contexts of scientific discoveries and mathematical theories. By examining how frequently and in what ways teachers and students engage with literature beyond their primary fields, we can identify potential gaps in their reading practices and areas for improvement. This analysis could lead to enhanced curricula encouraging interdisciplinary exploration, ultimately benefitting student comprehension and fostering a lifelong love of reading. Therefore, investigating these reading habits is a critical endeavor that can lead to more comprehensive educational practices. This exploration enriches the academic environment and lays the groundwork for more informed, culturally aware professionals in STEM fields. Through this understanding, we can better support educators and learners in enhancing their engagement with a broader spectrum of literature.

## 2. Previous Researches

Aristotle's early categorization of sciences into theoretical, practical, and productive divisions highlights an enduring framework that aids in understanding the nature of knowledge across disciplines. Theoretical sciences seek knowledge for its own sake, practical sciences focus on applications in ethics and politics, and

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productive sciences engage in creative processes such as poetry and rhetoric (Bechtel & Hamilton, 2007). This framework provides a foundational understanding of how knowledge can be compartmentalized yet suggests that proper understanding requires integration across fields. The emergence of STEAM education signifies a significant shift in pedagogical approaches, advocating for a more holistic and integrated curriculum. Recent studies suggest that this approach fosters students' creativity, innovation, and problem-solving skills, which are crucial for navigating complex global challenges. Research indicates that integrating the arts into science education can spark interest and excitement, enhance understanding of scientific content, and encourage engagement in scientific reasoning, reflective practices, and identity development (Ben-Horin et al., 2023). Both theoretical insights and practical applications of integrating arts and sciences in education can significantly enrich the learning experience, fostering a generation of learners with the necessary skills and sensibilities for the future.

Chemistry, the study of matter and its interactions, profoundly influences various aspects of human life, from developing essential materials to advancements in health and technology. The relationship between chemistry and HSS is multifaceted, encompassing ethical considerations, educational practices, and the role of chemistry in addressing global challenges. Chemistry has been crucial in developing products and technologies that improve human living standards. From pharmaceuticals that enhance health to materials that enable modern conveniences, chemistry is intrinsic to economic growth and societal advancement. In examining the intersections between chemistry and social responsibility, Mehlich et al. (2017) argue that chemists have a moral obligation to adhere to ethical standards and to engage in discussions about the societal implications of their work. They emphasize the importance of integrating ethical considerations into chemical education and practice, advocating for a paradigm shift towards a more sustainable and responsible approach to chemistry. The ethical landscape in chemistry encompasses various principles, including research, professional, and technology ethics. Discussions about chemistry and ethics highlight the need for chemists to navigate the complexities of their discipline, mainly when ethical dilemmas arise at the intersection of science, technology, and societal needs. In addressing sustainability issues, chemists must consider chemical production and use's environmental and social impacts. Evaluating ethical principles in chemical management provides a foundation for broader discussions about improving risk assessment methodologies and promoting safer practices (Mehlich et al., 2017). Effective chemistry education is paramount in shaping future generations of chemists who can think critically about ethical implications and societal impact. Traditional models of chemistry education often focus on rote memorization of content, neglecting to develop students' understanding of the interdisciplinary nature of science (Freire et al., 2019). Research suggests that a pluralistic approach to teaching chemistry—incorporating historical and philosophical perspectives—can enhance students' appreciation of the subject. This shift in pedagogy acknowledges chemistry as a dynamic and evolving field that interacts with societal values and challenges. Freire et al. (2019) propose using conceptual profiles theory to characterize the unique attributes of chemistry and advocate for an educational framework that supports teachers in enriching their instruction. They highlight the importance of addressing teachers' attitudes towards the integration of history and philosophy of science in the curriculum, as these views significantly impact pedagogical practices. Their findings indicate that educators with professional development in history and philosophy tend to favor incorporating these perspectives into their teaching. Chemistry is also pivotal in tackling pressing global issues, such as climate change, energy sustainability, and health crises. As the world faces environmental degradation and resource scarcity, the chemical sciences must lead innovative solutions grounded in sustainable practices. The growing field of green chemistry seeks to reduce the environmental impact of chemical processes by designing products and processes that minimize waste and energy consumption. This focus aligns with broader human needs for sustainability and responsible stewardship of the planet. The interplay between chemistry and HSS is complex and necessitates a holistic understanding of ethical implications and educational practices. As chemists navigate their responsibilities toward society, it is essential that they engage in ethical discourse, adapt educational methodologies, and contribute to sustainable innovations. A commitment to integrating these elements into the practice and teaching of chemistry will empower future generations to address the challenges of the modern world with a sense of responsibility and awareness of the broader context of their work. This underscores the necessity of a comprehensive approach to chemistry study that embraces its ethical dimensions, enriches educational practices, and fosters a sustainable future for humanity.

The relationship between mathematics and HSS has garnered increasing attention in recent years,

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particularly as the digital age reshapes our understanding of both disciplines. Scholars from various fields have explored how mathematical concepts and algorithmic processes influence social behaviors, cultural norms, and ethical considerations, engaging with the complexities of the human condition. As Rieder (2016) noted, algorithmic techniques offer a unique lens through which the HSS can examine the underlying principles of software creation. These techniques allow for the ordering and filtering vast amounts of information, thus playing a pivotal role in how society interprets ratified reality. The Bayes classifier, for instance, serves as a case study for understanding what it means to wield power through algorithmic decision-making. Researchers can better appreciate the technical frameworks that inform social narratives by conceptualizing software as a cultural artifact. Dirks (2022) furthers this discourse by emphasizing the ethical implications for creators of algorithms. As technology evolves, the potential for bias becomes a significant concern. Many programmers strive to eliminate bias from their algorithms, only to discover entrenched societal values inscribed within their datasets. This cyclical challenge highlights the need for a deeper understanding of the ethical dimensions of technology, echoing a call for collaboration between technologists and HSS. In essence, the values inherent in algorithmic systems often reflect broader social dynamics, necessitating a more concerted effort to address these biases in meaningful ways. As we delve into the nature of our existence in an increasingly digital world, the HSS serves as a guiding force. Banda (2024) articulates that understanding human behavior and cognition is essential in navigating the complexities of our modern age. The interplay of HSS with technological tools like AI and GenAI offers a nuanced approach to societal challenges. Rather than simply viewing data as numbers, it is crucial to appreciate the human stories behind the data. This perspective fosters a more equitable digital environment where every voice is acknowledged and valued. The convergence of mathematics, technology, and human sciences marks a new-age renaissance. This synthesis emphasizes the importance of empirical data, computational power, and the ethical and qualitative dimensions of human experience. As digital interactions shape our understanding of ourselves and each other, principles such as equity and quality become foundational. The narratives emerging from these interactions invite us to consider the merit of our scientific endeavors, driving us to pursue better, more insightful technology applications. As algorithmic techniques reshape our social landscapes, it is essential to recognize the ethical responsibilities of creators in this digital age. By bridging the gap between technical expertise and humanistic inquiry, we can collectively strive for a more equitable and insightful understanding of the varied dimensions of human life. The collaborations between HSS and technological advancements offer an opportunity to enhance our grasp of the complexities of human behavior, ultimately resulting in a more prosperous, more comprehensive outlook on society's challenges.

The intersection of physics and HSS offers a rich and complex landscape for exploration, mainly as advancements in physics affect societal norms, policies, and ethical considerations. This literature review aims to synthesize key insights from various studies addressing the implications of physical sciences on human life, drawing from diverse perspectives, including philosophy, sociology, and ethics. Philosophers have long debated the implications of physical theories on our understanding of humanity. The interconnectedness of all things has significant implications for human consciousness and social interaction, urging a re-examination of how science relates to ethical considerations and collective well-being. Kirk (2020) expands on these notions by arguing that physics paradigms do not exist in a vacuum but are influenced by social values, ethics, and priorities. This positions the practice of physics as inherently tied to human experience, necessitating a dialogue between disciplines. The practical applications of physics have profound implications for humanity. For example, the development of nuclear energy highlights the dual-edged nature of scientific advancement. At the same time, it presents opportunities for energy generation but also introduces risks associated with safety, environmental concerns, and ethical dilemmas regarding weaponry (Verma, 2021). These challenges underscore the need for a philosophical framework integrating scientific understanding with ethical decision-making. Moreover, the prevailing discourse on climate change emphasizes the urgency of transitioning to sustainable energy sources, where the physics of renewable energies plays a crucial role in shaping public policy and societal priorities (Meyer et al., 2021). The relationship between physics and environmental policy exemplifies the need for interdisciplinary approaches that include social scientists, environmentalists, and ethicists to align the technological capabilities of physics with the values and needs of society. Human perspectives and cultural contexts significantly shape scientific research and its applications. Spijkerboer et al. (2022) noted that while primarily viewed through a technological lens, geothermal energy necessitates a social science discourse to explore its ramifications for different communities. This indicates a growing recognition

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of integrating HSS into physically grounded scientific discussions, enriching our understanding of how technologies impact societal dynamics. Furthermore, complexities arise in multidisciplinary research contexts where scientists and policymakers must negotiate conflicting interests and values. The need for collaborative frameworks, where scientists are viewed as partners rather than authoritative figures, is essential for effectively addressing the challenges posed by complex socio-technical systems (Johnson, 2010). It is increasingly evident that a multidisciplinary approach is essential to grasp physics implications for humanity. Expanding the dialogue between physical scientists, social scientists, and humanities scholars is crucial for addressing contemporary challenges such as climate change, energy transitions, and technological ethics. Identifying methodologies incorporating diverse epistemologies will enhance our capacity to understand and address the multifaceted issues at the intersection of physics and human experience. By fostering interdisciplinary collaborations, researchers can develop innovative solutions that not only leverage the strengths of physical science but also consider the societal contexts in which they operate. The relationship between physics and HSS is complex and multifaceted, with critical implications for ethics, policy, and social equity. Addressing the challenges of modern society requires a collaborative effort that bridges disciplines, ensuring that scientific advancements enrich the human experience and foster a sustainable future. Emphasizing the importance of dialogue between physics and HSS will be essential in navigating the implications of scientific progress on humanity at large.

Integrating science and HSS has become a focal point in contemporary academic discourse, with growing recognition of the importance of bridging these two traditionally distinct fields. The argument for integrating HSS into STEM education is anchored in the belief that the laws governing mathematics and natural sciences, while universal, are often insufficient in addressing the nuanced realities of human experience and societal needs (Webb, 2008). This sentiment is echoed by Josa and Aguado (2021), who assert that engineers with HSS knowledge are better positioned to make informed decisions considering their work's social and cultural contexts. The pressing challenges of the contemporary world, such as climate change and public health crises, necessitate a broader skill set that includes both scientific acumen and an understanding of human behavior and societal dynamics. Proponents of integrating HSS into engineering curricula argue that humanities courses are critical in nurturing communication skills and creative thinking (Webb, 2008). By exposing students to diverse perspectives and alternative discourses, these courses encourage engineers to view problems through multifaceted lenses, thereby enhancing their innovative capacities. This is particularly vital in fields like engineering, where marginalizing technical professionals from decision-making processes can hinder the development of socially responsible solutions. Including HSS in STEM education promotes a more balanced individual development, allowing students to comprehend the impacts of technology on everyday life (Webb, 2008). Addressing the sociological dimensions of engineering practices cultivates a sense of ethical responsibility among future engineers, aligning their professional endeavors with civic engagement and community well-being. This perspective aligns with the growing emphasis on social sustainability in engineering practices, highlighting the need for engineers to engage with broader societal implications (Josa & Aguado, 2021). Despite the compelling arguments for integration, significant challenges remain. Historically, the divide between the exact sciences and the HSS has persisted in academia, leading to a reluctance to intertwine the two domains (Lieberknecht et al., 2022). The traditional emphasis in many grand challenge initiatives has been on technological solutions, often sidelining the essential contributions of HSS. This tendency reflects a broader issue wherein non-academic stakeholders and disciplines must collaborate effectively, particularly in addressing urgent social and environmental challenges. The integration of HSS into STEM fields has taken various forms, as observed in interdisciplinary programs and collaborative research initiatives. For instance, in addressing climate change, successful case studies have emerged where cross-disciplinary teams engage both technical experts and humanities scholars to develop comprehensive solutions that are socially and culturally informed (Lieberknecht et al., 2022). These partnerships illustrate the potential for innovative solutions considering human societies' multifaceted nature. The literature on integrating science and HSS underscores the necessity of a holistic educational approach that prepares engineers and scientists to engage meaningfully with societal challenges. While the road to meaningful integration is fraught with obstacles, the potential benefits of fostering a more inclusive and interdisciplinary perspective are significant. As the complexity of global challenges continues to escalate, the intersection of STEM and HSS will be vital in cultivating a generation of professionals capable of addressing the intricate tapestry of human experience through informed and compassionate action.

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Investigating scholars' information behaviors reveals various strategies to optimize reading and comprehension. Critical practices include skimming, reading, underlining, note-taking, chaining, differentiating, direct searching, browsing, data collection, data analysis, organizing, collaborating, networking, writing, monitoring, presenting, and teaching (Graham, 2020). Some scholars have developed tailored strategies for their reading processes. For example, browsing often begins with locating a familiar item via a library catalog or another search method, after which researchers browse nearby resources to uncover additional relevant materials. The rise of digital technologies has significant implications for reading habits. Direct searching entails a focused inquiry using bibliographic databases, catalogs, websites, or other sources. Chaining is particularly noteworthy, as it involves tracing citation connections between various works through backward chaining (exploring references cited in consulted material) and forward chaining (identifying works that cite previously known material). Resources from reputable authors, journals, or respected publishing houses were more likely to be pursued over those from lesser-known sources. It is conceivable that this tendency toward shallower reading modes, induced by greater screen use, may hinder one's ability to engage deeply with literary texts, thereby affecting motivation and the desire for slower, more reflective reading. Frequent screen reading of short texts correlates with a lower inclination to exert the cognitive effort necessary to engage with longer works and contemplate their more profound, personally meaningful interpretations (Hakemulder & Mangen, 2024).

Limitations in current research often arise from the narrow scopes and limited sample sizes, which may fail to capture students' and educators' diverse experiences and needs across various contexts. These constraints underscore the pressing need for future research initiatives to adopt a broader approach. It is essential to enhance both the size of the samples and the diversity of investigations to address the varied conditions present within educational environments adequately. By taking these steps, researchers can more effectively illuminate the complexities of integrating HSS into STEM, thereby contributing to a more nuanced understanding of how these disciplines can work together to improve educational outcomes in an increasingly interconnected world.

## 3. Date and Methods

The present study investigates the book borrowing trends of 4,403 borrowers from the chemistry, mathematics, and physics departments from 2014 to 2023. 36,527 books were borrowed, culminating in an aggregated borrowing tally of 64,641 across the three disciplines: chemistry accounted for 25,219 borrows, mathematics for 21,644, and physics for 17,778.

To facilitate a detailed analysis, the borrowing volume associated with each classification category of books, as delineated by the Chinese Library Classification System, will be computed for each department over the past decade. Subsequently, these categories will be ranked in descending order based on borrowing frequency to ascertain the correlation between multiple-level variables.

The resulting ranking table will be imported into SPSS for further statistical examination. Within the SPSS interface, users will navigate to the analyze menu, select nonparametric tests, and then opt for legacy dialogs to initiate the k-related samples procedure. Test variables will be specified as the ranks of the chemistry, mathematics, and physics departments.

The classification numbers, denoted from A to K, will be assigned numerical values as follows: A = 1, B = 2, C = 3, D = 4, DF = 5, E = 6, F = 7, G = 8, H = 9, I = 10, J = 11, K = 12. Departmental assignments will follow: chemistry = 1, mathematics = 2, and physics = 3. To import the borrowing records from the three departments into SPSS, select the date and weigh the cases based on frequency. In the subsequent analysis, select dimension reduction under the analyze tab, followed by correspondence analysis. For this analysis, the book categories (1 to 12) will serve as the row variable, while departmental affiliation (1 to 3) will be utilized as the column variable.

Additionally, an annual average borrowing figure for liberal arts literature will be computed across the three departments. Using EXCEL, a scatter plot with trend lines will be generated to project the anticipated yearly borrowing average for 2024.

Using Gephi, borrowing network diagrams will be constructed for the three departments, representing readers as nodes and their corresponding borrowing relationships with various titles as edges. Statistical analyses will afford calculations of connectivity metrics for each node, enabling the generation of stable borrowing core diagrams for each department via topological network filtering.

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The second-level categories of the Chinese Book Classification System will make further refinements to classify borrowed texts. The book circulation records from the three departments will be imported into SPSS, where cases will be weighted by frequency. KMO and Bartlett's Test will be conducted as part of a factor analysis procedure, incorporating gender and the volume of books borrowed as variables. The principal component analysis will be employed for extraction, while the varimax method with Kaiser normalization will be utilized for rotation.

Finally, structural equation modeling diagrams will be constructed in AMOS, enabling the calculation of correlation coefficients between observed and latent variables and covariance coefficients between latent variables.

## 4. Results

### *4.1. Gender Comparison*

Table 1 shows the gender of the readers who borrowed each book category. From a gender comparison perspective, men tend to prefer borrowing books related to Marxism (A) and military literature (E) more than women, with the most noticeable difference between them being the borrowing of language (H) and literature (I) books. In examining the borrowing patterns of readers across different book categories, Table 1 offers valuable insights into gender preferences. The data indicates a notable trend in the genres favored by male and female readers, particularly highlighting the divergence in interests regarding specific categories such as Marxism (A) and military literature (E).

**Table 1.** Gender of book borrowers (2014-2023).

| Category | Male | Female | Total | Male : Female |
|---|---|---|---|---|
| A | 164 | 138 | 302 | 118.84% |
| B | 1931 | 2977 | 4908 | 64.86% |
| C | 712 | 1322 | 2034 | 53.86% |
| D | 349 | 495 | 844 | 70.51% |
| DF | 258 | 370 | 628 | 69.73% |
| E | 238 | 89 | 327 | 267.42% |
| F | 1846 | 2764 | 4610 | 66.79% |
| G | 1883 | 4148 | 6031 | 45.40% |
| H | 1346 | 4312 | 5658 | 31.22% |
| I | 7609 | 23536 | 31145 | 32.33% |
| J | 469 | 914 | 1383 | 51.31% |
| K | 3121 | 3650 | 6771 | 85.51% |
| Total | 19926 | 44715 | 64641 | 44.56% |

Men demonstrate a pronounced inclination towards books on Marxism, suggesting a possible cultural or academic interest in political theory and economic systems that may resonate more with them. This preference could be influenced by societal norms, educational backgrounds, or historical contexts shaping male engagement with these subjects. Similarly, the interest in military literature (E) reveals another area where men significantly outpace women in borrowing rates. This could be attributed to traditional gender roles where male readership is more commonly associated with conflict, strategy, and warfare themes. The portrayal of military narratives in media and culture may also play a role in steering this gendered preference.

On the other hand, the stark contrast observed in borrowing language (H) and literature (I) books is particularly telling. Women tend to engage more with these categories, preferring subjects that may foster emotional connections, cultural understanding, and interpersonal dynamics. The distinct difference in borrowing patterns suggests that women value literary expression and the nuances of language in a way that contrasts sharply with the interests seen in male readers in the three departments.

This analysis underscores the importance of recognizing gender differences in literary preferences. It reflects broader social trends that can inform publishers, educators, and librarians as they strive to create an inclusive environment that caters to the diverse interests of all readers. Understanding these patterns also opens avenues for further research into how various socioeconomic and cultural factors influence reading habits across genders.

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### *4.2. Department Comparison*

#### *4.2.1. Favorite Book Categories*

Table 2 illustrates the rank of book categories in the three departments. Kendall's coefficient of concordance is 0.016. Asymp. Sig. is 0.826. The three departments' interest levels in liberal arts books demonstrate inconsistency, as indicated by the low Kendall's coefficient of concordance. Furthermore, the observed differences in interest are not statistically significant. The chemistry department prefers borrowing literary (I) books, while the mathematics department favors legal (DF) books. Additionally, the physics department opts for educational (G) books the most.

**Table 2.** Rank of book categories (2014-2023).

| Category | Che. Dep. | Mat. Dep. | Phy. Dep. |
|---|---|---|---|
| A | 12 | 2 | 5 |
| B | 4 | 9 | 4 |
| C | 7 | 3 | 8 |
| D | 9 | 6 | 11 |
| DF | 10 | 1 | 12 |
| E | 11 | 8 | 2 |
| F | 6 | 12 | 3 |
| G | 5 | 10 | 1 |
| H | 2 | 5 | 10 |
| I | 1 | 11 | 7 |
| J | 8 | 4 | 9 |
| K | 3 | 7 | 6 |

**Note:** Kendall's coefficient of concordance is 0.016. Asymp. Sig. is 0.826.

The coefficient reveals minimal concordance in the book preferences across the chemistry, mathematics, and physics departments. The high significance level further reinforces this finding by suggesting that the disparities in book preferences are more likely due to chance rather than a systematic preference trend among the departments. This lack of significant difference implies that the departments' choices in literature do not align with their academic focuses, which is unexpected, given that one might anticipate a correlation between the departments' subject matter and the types of books they prefer. When examining the specific preferences of each department, we see contrasting choices that highlight their distinct academic cultures. The chemistry department's inclination towards literary books may suggest an interest in interdisciplinary approaches or a desire for narratives that enhance creativity beyond the scientific realm. In contrast, the mathematics department's preference for legal books could indicate a focus on analytical reasoning or a quest for understanding the implications of mathematics within legal frameworks, hinting at a practical application of mathematical principles. The physics department's selection of educational books aligns with its pursuit of knowledge and principles underpinning its field, emphasizing an inclination towards learning and academic growth.

These findings signal a unique aspect of academic culture within these departments, suggesting that while they may be grounded in their respective disciplines, their literary interests are more diverse and reflective of broader intellectual pursuits. This diversity could provide opportunities for interdisciplinary collaboration and discussions that enrich the academic environment across these departments. Future research could investigate the underlying reasons for these preferences and whether they change over time or in response to external influences, such as curricular changes or societal trends.

#### *4.2.2. Correspondence Analysis*

The sum of the proportion of inertia of dimensions 1 and 2 is 1. This indicates that the two dimensions are highly interpreted. Figure 1 also confirms the above statistic result that the chemistry department prefers literature, the math department prefers social science, politics, laws, and the arts, and the physics department prefers military and education.

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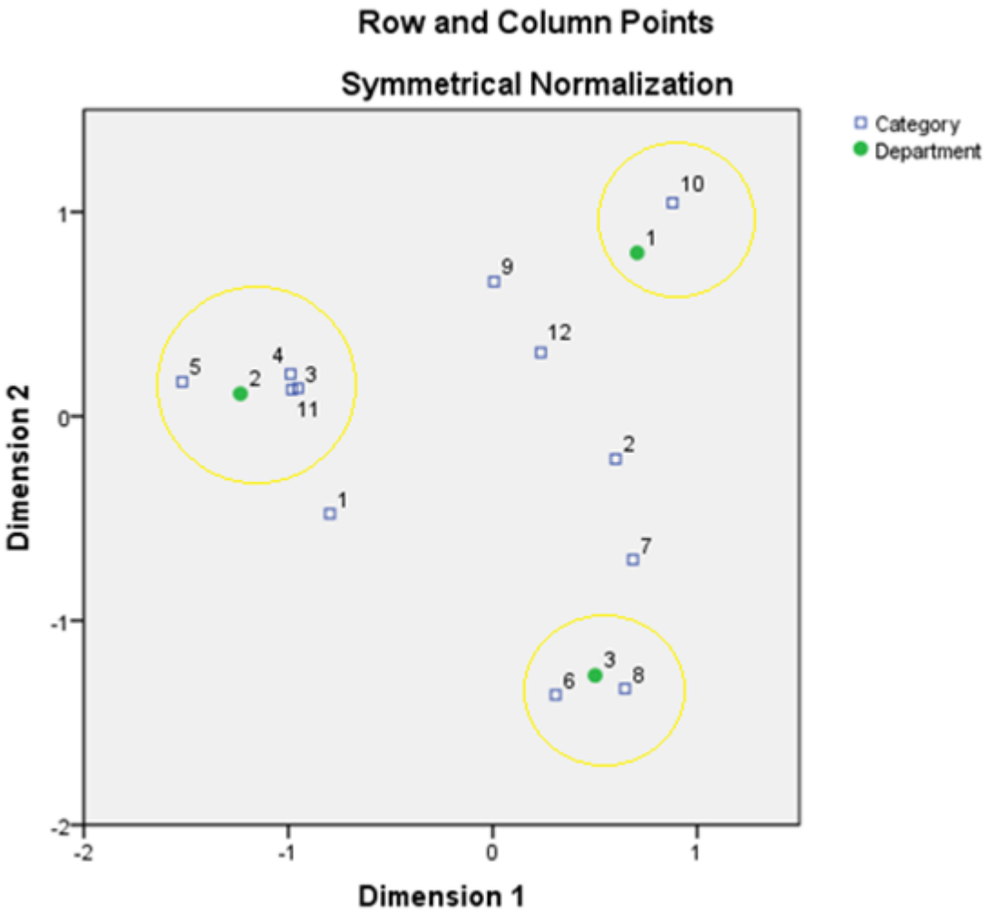



**Figure 1.** Correspondence between book categories and departments.

The analysis of inertia proportions indicates a significant correlation between disciplinary preferences within the departments assessed. The sum of the proportions for dimensions 1 and 2 equaling 1 suggests that these dimensions encapsulate the majority of the variability in the data, highlighting a strong interpretative quality. In examining the specific preferences of each department, distinct academic inclinations emerge. The chemistry department's preference for literature may suggest a tendency towards narrative and critical thinking skills essential in understanding complex chemical processes or the societal impacts of chemistry. This inclination could foster an environment where creativity and qualitative analysis are valued, potentially leading to interdisciplinary collaborations. Conversely, the math department's preference for social sciences, politics, laws, and the arts implies an application of quantitative reasoning to sociopolitical issues and human behavior. This cross-disciplinary approach might reflect an understanding of mathematical modeling's role in social phenomena, highlighting the importance of analytical skills in interpreting societal trends. The physics department's focus on military and education illustrates a different facet of how physical principles apply to real-world situations, from defense technology development to pedagogical approaches in teaching complex scientific concepts. This suggests a pragmatic application of physics in fields that require rigorous problem-solving and analytical skills.

Correspondence analysis reinforces these insights, providing a visual representation that aids in understanding the underlying patterns of departmental preferences. The data highlights how each department's unique focus contributes to a broader interdisciplinary dialogue, promoting a comprehensive approach to education and research. This understanding can inform future curriculum development and department collaboration, fostering a more integrated academic environment.

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*4.2.3. Prediction of per Capita Book Borrowing Volume*

Figure 2 shows that the borrowing volume of humanities books in the three departments has decreased yearly. The per capita book borrowing volume changes linearly in the chemistry and physics departments, while the changes in the mathematics department are non-linear. Roughly estimated by the linear function, by 2024, the average borrowing volume per person in the chemistry department will be about 4.5, and the physics department will be about 4.3. Based on a two-period moving average algorithm, the value of the mathematics department will be about 5.1. During the outbreak of COVID-19, the department of mathematics borrowed more liberal arts books than expected.

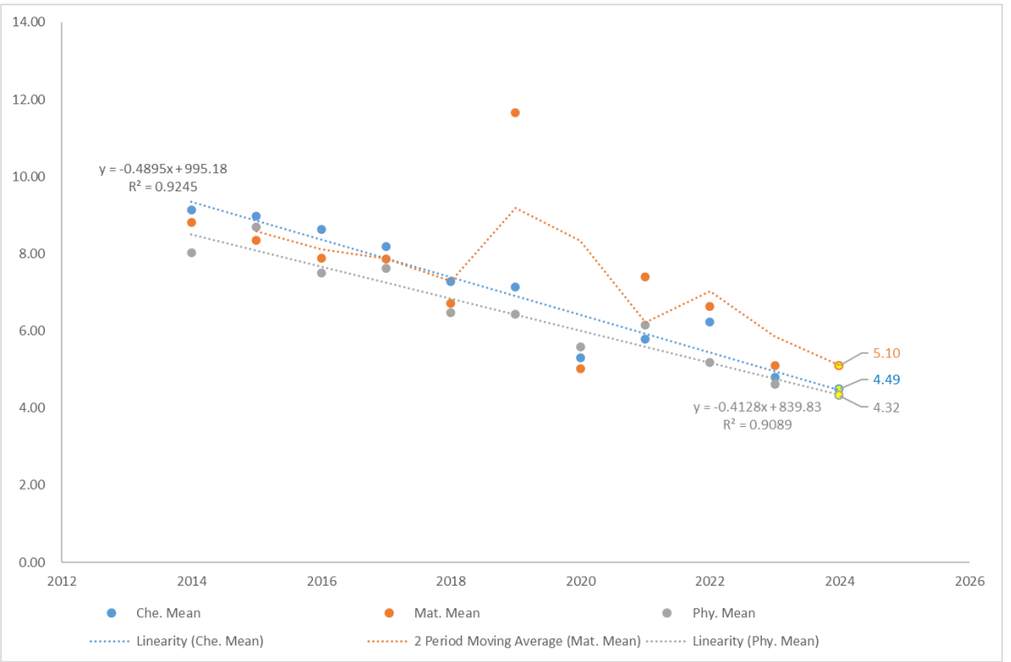



**Figure 2.** Per capita book borrowing volume.

The decline in borrowing volumes suggests a potential shift in how students in these disciplines engage with humanities literature. This trend might be linked to various factors, including changes in curriculum, increased emphasis on digital resources, or a diversion of focus toward STEM-related materials. The linear pattern observed in the chemistry and physics departments may indicate a stable, predictable student borrowing behavior, possibly driven by consistent academic requirements or a steady integration of humanities into their studies. In contrast, the mathematics department's non-linear borrowing pattern could imply fluctuations influenced by specific events, such as guest lectures, seminars, or shifts in curriculum emphasis that temporarily heighten interest in humanities resources.

The projected borrowing volumes suggest that students in the chemistry and physics departments will continue to engage with humanities literature at a gradually declining rate by 2024. However, while also experiencing a decrease, the mathematics department is projected to have a higher average, indicating a relatively more substantial interest or requirement for humanities books that differs from the other disciplines. The observation that the mathematics department borrowed more liberal arts books than expected during the COVID-19 outbreak is particularly noteworthy. This increase could reflect a shift in focus as students sought more diverse reading material during lockdowns or to engage with broader themes and perspectives in a time of global uncertainty. The pandemic prompted a reconsideration of the relationship between their field and the humanities, leading to greater borrowing.

These findings suggest that academic departments may benefit from strategically reviewing how humanities content is integrated into their programs. Understanding the factors that led to increased borrowing in the mathematics department during the pandemic could help inform future curriculum designs and encourage interdisciplinary engagement. The declining trend in borrowing volumes highlights a need for

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departments to assess and revitalize their approach to integrating humanities literature within their curricula, ensuring students are encouraged to explore these materials beyond their core disciplinary focus.

*4.2.4. Core Structure of Book Borrowing*

According to the borrowing relationship structure depicted in Figure 3, readers in the physics and chemistry departments demonstrate a relatively stable core when it comes to borrowing humanities books, showing a consistent recognition of these works within their departments. In contrast, mathematics majors exhibit a more erratic pattern in borrowing liberal arts books, lacking the same level of stability.

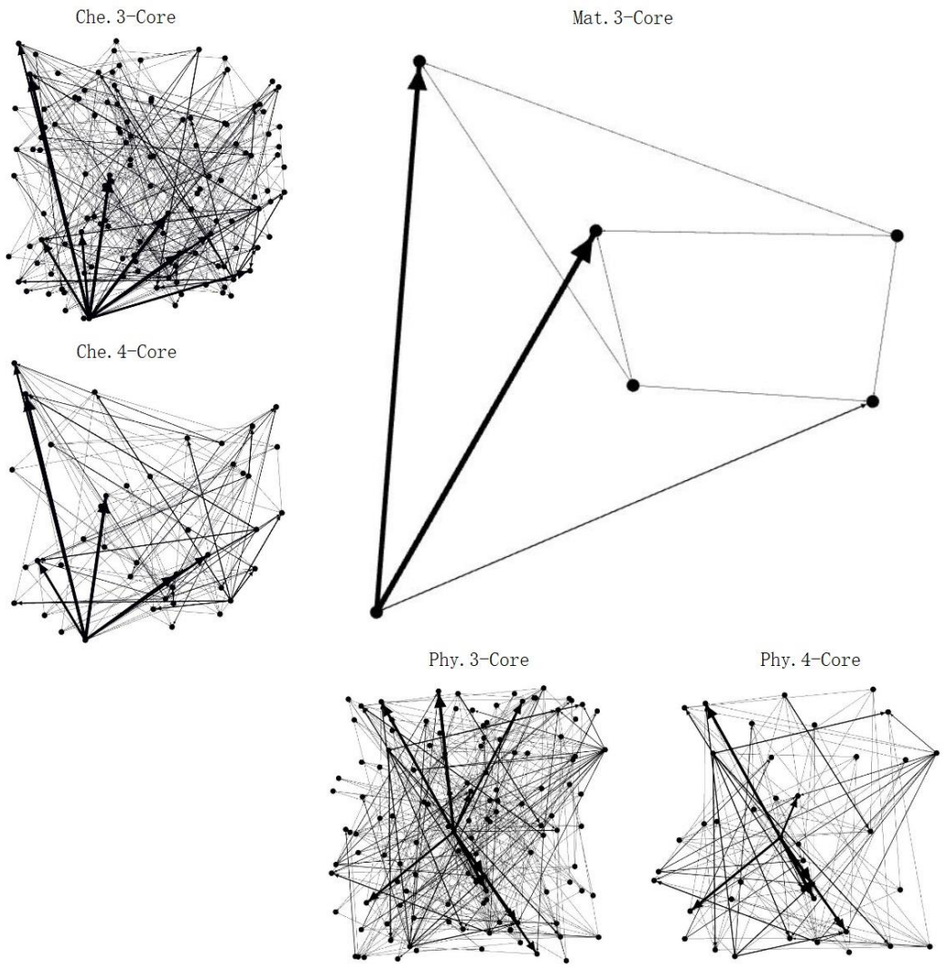



**Figure 3.** Core structure.

The consistent borrowing patterns in the departments of physics and chemistry suggest a strong, stable core of interest in humanities books. This stability may reflect a few underlying factors. These departments often emphasize interdisciplinary approaches, recognizing that insights from the humanities can enhance critical thinking and ethical reasoning in scientific contexts. This might explain the sustained appreciation for humanities works as students and faculty seek to contextualize their scientific pursuits within broader societal frameworks. Additionally, the consistent borrowing could indicate curricular integrations where humanities books are included in syllabi or recommended readings, fostering a culture of appreciation and inquiry that transcends disciplinary boundaries. This suggests that faculty actively promote these works, encouraging students to engage with themes that enhance their understanding of the human condition, ethics, and the social implications of scientific advancements.

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On the other hand, the erratic borrowing patterns observed among mathematics majors raise intriguing questions about the challenges faced in integrating liberal arts into their academic experience. The irregularities could indicate a less formal relationship between mathematics and humanities, reflecting a perception that these fields are distinct and often disconnected. Mathematics, a discipline grounded in logic, abstraction, and quantitative analysis, may not inherently align with the qualitative explorations of the humanities. Thus, students in this field might not see the immediate relevance of humanities literature to their studies, resulting in less frequent engagement. Moreover, this disparity also reflects differences in departmental culture or the professional trajectories that mathematics students anticipate. If the focus is primarily on technical skills and theoretical applications, there may be less impetus to seek out liberal arts literature. This could perpetuate the gap as students, and faculty become accustomed to prioritizing resources that align closely with their disciplinary paradigms.

In light of these observations, promoting excellent interdisciplinary initiatives could benefit all departments. Collaborative programs that bridge the gap between the sciences and humanities, such as interdisciplinary seminars or joint projects, could encourage a more fluid exchange of ideas and resources. By fostering an environment that values diverse perspectives, departments might enrich their academic culture and prepare students to navigate an increasingly complex and interconnected world. Understanding these borrowing patterns sheds light on how academic disciplines interact and the potential benefits of fostering a more integrated approach to education that values quantitative and qualitative knowledge dimensions.

### *4.3. Latent Variable Analysis*

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score of 0.922 suggests that the sample is highly suitable for factor analysis, indicating a strong correlation among variables. The significance level of 0.000 reinforces the conclusion that the relationships among the data are indeed statistically significant and not due to chance. Two common factors were extracted from the categories of books and the gender of readers; Table 3 demonstrated the rotated component matrix of the two factors.

**Table 3.** Rotated component matrix.

| | **Component** | |
|---|---|---|
| | **1** | **2** |
| Biography | 0.98 | 0.08 |
| Geography | 0.97 | 0.03 |
| Archaeology | 0.96 | 0.05 |
| History | 0.96 | 0.14 |
| Art | 0.95 | 0.01 |
| Education | 0.89 | 0.08 |
| Culturology | 0.88 | 0.03 |
| Politics | 0.87 | 0.11 |
| Chinese | 0.84 | 0.06 |
| Philosophy | 0.75 | 0.39 |
| Military Affairs | -0.09 | 0.70 |
| Marxism | 0.35 | 0.61 |
| Gender | -0.20 | -0.62 |

Factor 1 represents diverse interests. Diverse interests (F1) encapsulate various literary preferences and suggest an openness among readers. This could reflect broader cognitive engagement with various genres, themes, and ideas, underscoring a trend towards interdisciplinary reading habits. Readers in this category may exhibit a penchant for exploring diversity in genres, motivated by a desire for holistic understanding and cultural literacy. Further examination might reveal which specific genres or themes resonate with this group and whether this openness correlates with personal or sociocultural factors such as education level, socioeconomic status, or exposure to diverse perspectives. Understanding how age or life experiences influence diverse reading habits could yield interesting insights.

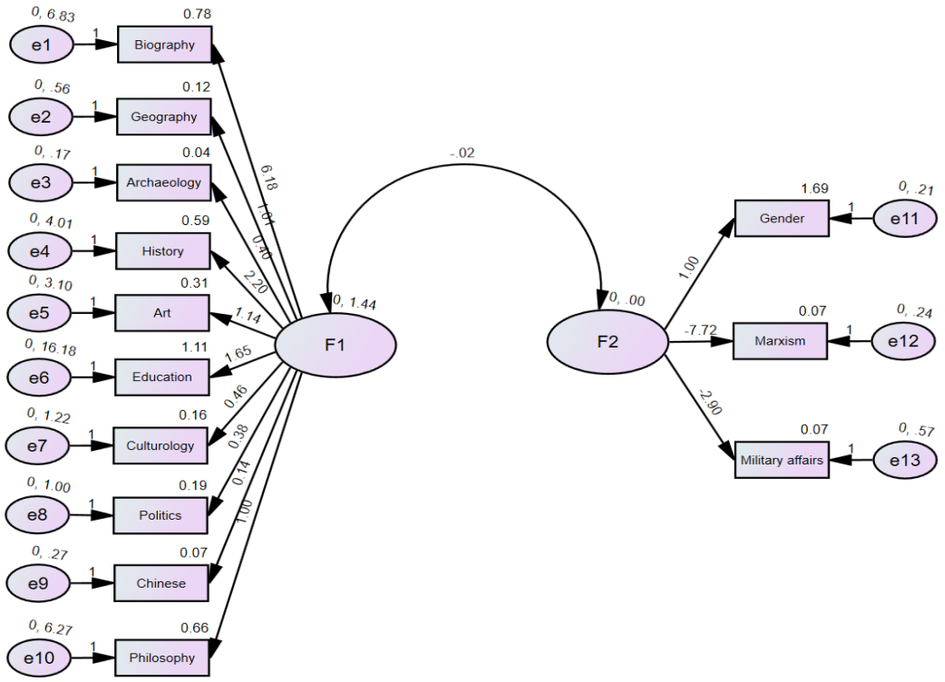
Factor 2 represents male-dominated Marxist military interests. Male-dominated Marxist military interests (F2) may suggest a more niche readership that aligns with specific ideological and historical contexts. This

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factor might reflect an interest in military literature and Marxism. However, it could also intersect with concepts of masculinity in reading habits, elevating the cultural narrative that associates military themes with male readers. Investigating the motivations behind this interest can be enlightening. Are these readers primarily attracted to the themes of power, control, and ideology typical of military narratives? Understanding their background could correlate with their reading preferences, potentially linked to military affiliations, historical events, or educational backgrounds in political science or history.

According to the structural equation calculation results in Figure 4, the covariance between F1 and F2 is -0.022, and their correlation estimate is -0.374. The slight covariance suggests that the connection between these two factors is minimal, implying that the two reading interests are distinct, though they may occasionally overlap in complex ways. This distinction raises questions about the broader societal implications of such preferences, whether the movement toward diverse interests signifies a value shift or a critique of established literary traditions. The negative correlation between F1 and F2 indicates an inverse relationship, suggesting that readers' focus on Marxist military literature diminishes as they engage more with diverse literary interests. This could indicate a broader cultural shift in which contemporary readers favor progressive, inclusive, and diverse narratives over more traditional or ideologically rigid texts.




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| Standardized Regression Weights | | | Estimate |
|---|---|---|---|
| Gender | <--- | F2 | 0.108 |
| Marxism | <--- | F2 | -0.623 |
| Military Affairs | <--- | F2 | -0.189 |
| Philosophy | <--- | F1 | 0.432 |
| Chinese | <--- | F1 | 0.315 |
| Politics | <--- | F1 | 0.417 |
| Culturology | <--- | F1 | 0.445 |
| Education | <--- | F1 | 0.441 |
| Art | <--- | F1 | 0.614 |
| History | <--- | F1 | 0.797 |
| Archaeology | <--- | F1 | 0.760 |
| Geography | <--- | F1 | 0.851 |
| Biography | <--- | F1 | 0.943 |

| Squared Multiple Correlations | Estimate |
|---|---|
| Biography | 0.890 |
| Geography | 0.725 |
| Archaeology | 0.578 |
| History | 0.635 |
| Art | 0.376 |
| Education | 0.194 |
| Culturology | 0.198 |
| Politics | 0.174 |
| Chinese | 0.099 |
| Philosophy | 0.187 |
| Military Affairs | 0.036 |
| Marxism | 0.388 |
| Gender | 0.012 |

**Figure 4.** Structural equation model.

In summary, these factors highlight important trends in reading habits that can inform educators, publishers, and marketers about shifting reader demographics and preferences. Future research could involve qualitative studies to explore the underlying motivations behind these reading patterns. Additionally, a more extensive demographic analysis, examining factors such as age, gender, and cultural background, could uncover patterns that further explain the interest in diverse literature versus specialized military narratives. The results provide valuable insights that suggest a need for an inclusive literary culture that caters to varied interests, advocating for diversity in literary offerings to engage potential readers who may fall into either category.

## 5. Discussion

### *5.1. Openness*

The per capita borrowing volume of 4-5 humanities and social science books in 2024 is anticipated to decline compared to figures from a decade ago. Nevertheless, this trend suggests that humanities and social sciences maintain a presence in the reading preferences of science and engineering audiences. The inverse correlation between potential multi-category needs and singular needs further underscores the diversity of

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readers' psychological motivations for engaging with literature. The relationship between the Arts and Sciences in university settings has often been characterized as a disconnect, with each discipline operating within its realm. Dirks (2022) highlights a growing incomprehension between these two cultures throughout the 20th century, a divide that academic specialization needs to bridge. Instead of encouraging scientists to engage with literature or asking humanists to understand scientific theories, a broader cultural outlook is suggested to foster collaboration and understanding between these fields. This perspective is critical to bridging the gap, emphasizing integrating diverse academic disciplines rather than merely performing cross-disciplinary activities in isolation. Kaufman et al. (2016) affirm that openness is most closely linked to creativity and achievement, noting a differential impact of its two subdomains on creative outcomes in the arts versus the sciences. The distinction between openness to experience and intellect suggests that while artists may thrive on emotional and aesthetic engagement, scientists rely more heavily on cognitive reasoning. This differentiation underlines the necessity of acknowledging diverse modes of thought and expression, which may further aid in bridging the gap between arts and sciences. Notably, the additional influence of extraversion on artistic creativity underscores the complex interplay of personality traits affecting achievement across disciplines.

Further compounding the challenges students face in higher education is the significant hurdle of reading comprehension. Bergman (2024) notes that many students struggle with anxiety related to their reading tasks, recognizing that extensive reading is vital for academic success. This realization propels them toward developing active engagement strategies to enhance their reading skills, highlighting a critical need for ongoing support from educators. The need for disciplinary experts to aid in this transition cannot be overstated, as this support equips students with essential tools and methodologies for navigating their respective fields, which, in turn, can promote a more integrated approach to learning. Similarly, the discourse surrounding teacher education emphasizes the necessity of critical reflection on identity and practice in the context of diverse classrooms. Engaging with diversity requires educators to understand their positionality and that of their learners, advocating for a hermeneutic approach to teaching (Dirks, 2022). This approach encourages ongoing critical reflection that recognizes diversity as a multifaceted and dynamic phenomenon rather than viewing it as a series of discrete categories. By fostering an environment where teachers can interrogate their beliefs and practices concerning diversity, teacher education can cultivate a more empathetic and practical pedagogical approach, allowing educators to accommodate their classrooms' complexities better.

The concept of openness plays a crucial role in educational contexts, particularly in preparing teachers to address their students' diverse needs. Openness can be understood as a willingness to engage with differing perspectives, experiences, and identities. Teacher education must foster spaces for critical reflection on self, self-as-teacher, and education. This process of introspection is vital in helping educators understand their biases and assumptions, enabling them to approach diversity with a more informed and empathetic mindset. Openness also extends to the recognition of the complexities inherent in diversity. By embracing openness, teachers can cultivate an enriching educational experience that honors the complexities of both their own identities and those of their learners. This approach aligns with the notion that learning to be a teacher is a hermeneutic process aimed at understanding and engaging with the complexities of diversity in a meaningful way. As Liddicoat (2021) points out, an awareness of diversity as a complex, ever-present phenomenon enriches this process. It underscores recognizing individuals' potential resources in navigating their diverse realities.

### *5.2. Leisure Reading*

The role of leisure reading in academic libraries remains a pertinent topic, highlighting the evolving nature of library services and their alignment with user needs. Despite years of discussions, implementing leisure reading collections has yet to reach its full potential in many academic libraries. Many studies have surveyed the availability of these collections, revealing that while some institutions prioritize leisure reading, others are hindered by budget constraints and misconceptions regarding their academic mandate. Is reading humanities and social science books by students majoring in mathematics, physics, and chemistry merely a random leisure activity? This study reveals that the answer is no. Specific departments exhibit significant randomness, while others maintain a stable and robust humanities and social sciences core.

The concept of multiple and evolving goals in educational contexts, as explored by Wosnitza and Volet (2012), sheds light on the broader implications of leisure reading. Students learn with various goals beyond

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academic achievement, including social connections and personal well-being. In this light, leisure reading can be a pivotal resource, supporting students' diverse objectives and fostering a more holistic approach to education. Academic libraries can better serve their communities by recognizing the sociocultural factors influencing students' goals and their need for leisure reading.

The interplay between leisure reading and academic engagement is crucial. As institutions strive to provide inclusive services that reflect the needs of their patrons, promoting and facilitating leisure reading collections becomes essential. This enhances the library's relevance and contributes to a more fulfilling academic experience for students, aligning with their multifaceted goals. Various authors underscore that academic libraries should foster leisure reading, emphasizing its importance for relaxation and enjoyment and its potential to enhance overall learning and development. As noted by Watson (2014), libraries incorporating leisure reading materials can cultivate a richer educational experience by providing diverse formats, including graphic novels and magazines catering to academic and recreational interests. This dual purpose highlights the complexity of user needs and libraries' need to adapt their collections accordingly.

### *5.3. Gender Differentiation*

Only a few male readers borrow military books in teacher education, predominantly influenced by female culture. This limited borrowing results in very sparse data, significantly hindering algorithms' performance. The discussion surrounding gender differences, particularly in the context of STEM and academia, reveals a complex interplay of social biases, stereotypes, and institutional practices that continue to shape women's participation and representation in these fields. Historically, women's involvement in STEM has been significantly hindered by entrenched gender stereotypes that categorize these disciplines as more appropriate for men. The prevailing notion that fields like math and science are inherently masculine dissuades women from pursuing these areas and affects their self-perception and confidence in these subjects. According to Cimpian et al. (2020), women may opt out of PECS (physical, engineering, computer, science) and STEM fields generally due to a lack of confidence in their math abilities, the availability of alternative career paths that leverage their strengths in English or reading, an emphasis on work-life balance over salary, and distinct career aspirations. This framing points to the necessity of addressing these psychological and social barriers to foster a more inclusive environment in STEM. Moreover, the gender disparities observed in various STEM majors highlight that the challenge is not uniform across all fields. As noted, while the male-to-female ratio in biology and chemistry approaches parity, other areas, such as physics and engineering, still struggle with a significant imbalance, with ratios as high as 4-to-1. This suggests that these disciplines' culture, values, and expectations may still need to be conducive to attracting and retaining women.

Transitioning to the social sciences and humanities, exploring feminist thought and its impact on academic disciplines reveals additional layers of complexity. The study conducted by Pearse et al. (2019) demonstrates that gender inequality persists in these fields, particularly regarding representation in editorial positions and authorship. The findings point to a more significant proportion of gender-related research articles published in sociology than in economics, history, international relations, philosophy, and political science. This disparity could indicate that specific disciplines are more receptive to feminist scholarship, which might influence the visibility and acceptance of gender-related research. Furthermore, solid disciplinarity seems to play a crucial role in marginalizing feminist subfields. When traditional academic structures prioritize established disciplinary frameworks, they may inadvertently suppress innovative feminist perspectives that challenge the status quo. Resistance to interdisciplinary approaches can stifle the flow of feminist knowledge and its contributions to broader academic discourse. Addressing gender differences requires a multifaceted approach that considers the social, psychological, and institutional factors at play. Whether in STEM or the social sciences, fostering an environment that values diverse contributions and actively works against stereotypes will be essential in bridging these gender gaps and promoting equity in academia.

### *5.4. Social Context*

The discussion surrounding the role of social context in education is increasingly significant, particularly as universities shift toward specialization and professionalization in degree programs. According to Sánchez-Ostiz and Torralba (2024), this trend emphasizes competencies in specific fields and raises the need for an interdisciplinary framework that allows students to connect their learning with reality. This connection fosters

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ethical thinking and integrates the student's academic pursuits with their lives outside academia, which is crucial in today's complex societal landscape.

The importance of a robust social foundation cannot be overstated in teacher education. Bowman and Gottesman (2017) highlight that the sociocultural learning theory emphasizes that educators must develop a comprehensive sociocultural lens to support student learning effectively. Understanding social context is essential for pre-service teachers, as it enhances their capacity to engage with diverse communities and promotes an equity-centered approach to education. This perspective enables them to approach teaching as socio-politically engaged intellectuals who are responsive to the needs of students, families, and communities. As such, social foundations provide the necessary tools for teacher candidates to delve into the socio-historical forces that shape educational experiences.

Furthermore, real-life learning brings additional depth to discussing the social context in education. Shernoff (2024) articulates that real-life education emphasizes participation in social life and solving current real-world problems rather than merely preparing for future challenges. This shift towards experiential learning underscores the necessity of recognizing students as active contributors to societal discourse. The humanities and social sciences interplay enriches our understanding of these themes. For instance, as Kane (1998) outlined, a framework of human values exists that can harmonize cultural and historical contexts with ethical considerations. This framework encourages a comprehensive inquiry into human experiences, emphasizing valuing practices across diverse dimensions of life. Such a synthesis could illuminate how social context informs educational practices and policies.

Social science can provide valuable insights into how societies function and how human behavior impacts the environment, thus facilitating transformative change. As highlighted, the humanities can help social sciences identify new directions for inquiry and provide conceptual clarity (Case & VanderWeele, 2024). This interdisciplinary approach is essential since understanding the multifaceted nature of sustainability requires a comprehensive view that encompasses social, cultural, and ethical dimensions. Moreover, social science can be pivotal in framing environmental issues that resonate with communities, facilitating more effective and socially viable solutions. By providing a deeper understanding of the socio-political landscape, social scientists can assist in developing realistic proposals that not only address technical possibilities but also consider the social and political contexts necessary for implementation (Lidskog et al., 2022). The transformative change required to address sustainability challenges can only be achieved with a concerted effort from social scientists to broaden the scope of environmental problems and engage in collaborative, interdisciplinary work that respects the complexities of human experience and societal dynamics. As emphasized, the intersection of social science and humanities is fundamental to fostering a comprehensive understanding of sustainability and enhancing our collective capacity to effect meaningful change (Case & VanderWeele, 2024; Lidskog et al., 2022).

## 6. Conclusion

Analyzing book borrowing patterns across gender and academic disciplines reveals several significant trends and insights. Firstly, a distinct gender divergence is observed in the borrowing preferences, with men showing a more pronounced interest in Marxist and military literature. In contrast, women demonstrate a lesser inclination toward these genres. This pattern highlights underlying sociocultural factors influencing reading preferences across genders, particularly evident in language and literature books, where the contrasts in borrowing behavior are most striking. The varying levels of interest in liberal arts literature among the three departments indicate an inconsistency further substantiated by low statistical significance in the observed differences. This suggests that while the departments engage with humanities to different extents, the reasons behind these preferences may not be sufficiently impactful to alter overall trends significantly.

Furthermore, the decline in humanities book borrowing across the departments over recent years raises concerns about the engagement with liberal arts literature in a more scientific academic environment. The chemistry department's notable preference for literature, aligned with the mathematics department's inclination toward legal texts and the physics department's focus on educational materials, points toward a nuanced approach to disciplinary interests. The linear trend in borrowing patterns for chemistry and physics, contrasted with the non-linear shifts in mathematics, implies a more stable engagement with the humanities in the former, likely reflecting a more integrated view of these disciplines with liberal arts. The COVID-19 pandemic presented an anomaly, with the mathematics department demonstrating an unexpected increase in

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borrowing books in the liberal arts. This shift indicates changing priorities or circumstances that align with broader societal trends during times of crisis, prompting a reevaluation of reading materials and a search for a more diverse intellectual engagement.

Analyzing the stability of borrowing relationships further illustrates the consistency in the humanities engagement within the physics and chemistry departments, juxtaposed with the erratic borrowing patterns observed among mathematics majors. This volatility may indicate a need for more robust curricular integration of liberal arts in mathematics programs to foster a greater appreciation and consistent engagement with humanities literature. Finally, the factor analysis results suggest a complex interrelationship between diverse reading interests and male-dominated Marxism and military literature preferences. The negative correlation between these factors indicates that as individuals explore a broader range of literary genres, their engagement with more specialized male-centric literature diminishes. This emphasizes the importance of promoting a diverse literary culture that can enrich intellectual pursuits across all academic fields, fostering a holistic educational environment that values interdisciplinary exchange.

The findings highlight the critical need for academic institutions to foster a richer and more varied literary culture that enhances student engagement across all disciplines. Encourage collaborative programs between the humanities and sciences, such as joint seminars or reading groups that explore the intersections between liberal arts and STEM subjects. This could cultivate an appreciation for diverse literary genres among students in technical fields. Libraries should consider diversifying their collections to include more literature that resonates with both male and female readers, particularly in genres that have shown divergent borrowing trends. Featuring more women authors and a broader range of topics may appeal to a wider audience. Libraries should continue to monitor borrowing patterns to inform collection development strategies and identify shifts in student interests, particularly post-pandemic, to adjust offerings accordingly. The mathematics department may benefit from integrating more liberal arts content into its curriculum. This could be achieved by including humanities courses as required electives or incorporating literature and social sciences perspectives in mathematics courses. Initiatives like themed reading weeks or campaigns focused on specific genres may encourage students to explore literature outside their usual preferences, particularly during periods of crisis, as seen during the pandemic. Host workshops or panels that discuss the sociocultural influences behind gender differences in borrowing patterns, aiming to raise awareness among students about these biases and encourage more inclusive reading habits. University teaching faculty could be encouraged to create diverse reading lists that include a mix of genres and perspectives. This would help students appreciate a broader literary spectrum and challenge existing borrowing trends. Encourage student-led initiatives that promote reading and discussions around liberal arts topics, fostering a community engaged in diverse intellectual pursuits.

## 7. Limitation

While the study includes a substantial sample of 4,403 borrowers across three academic departments, it may only represent some students or borrowers within these fields. Variations in borrowing behaviors among different academic years or demographic groups (e.g., international and part-time students) could lead to skewed data. The analysis is solely based on borrowing records, which may not accurately reflect students' genuine interest or engagement with the literature. Some students may rely on digital resources or online materials not captured in physical borrowing statistics, potentially underrepresenting overall reading behavior. The study spans a decade (2014-2023), but the rapidly evolving nature of academic resources and accessibility may affect trends. Curriculum changes, the introduction of new courses, or shifts in departmental focus during this period may influence borrowing patterns that the study needs to account for. Relying on the Chinese Library Classification System for categorizing books may introduce bias. The first and second-level classifications may not fully encapsulate the diversity of subjects or interdisciplinary works that could resonate with students across departments. Specific statistical tools, such as SPSS and Gephi, may have inherent limitations based on the assumptions of the tests performed. For instance, outliers or multicollinearity can influence nonparametric tests and factor analysis results. The study is confined to a limited geographical area of NNU, it may not be generalizable to a broader population or institutions with different borrowing behaviors and resources. The research primarily focuses on borrowing volume and gender as variables. Other potentially influential factors, such as social interactions, extracurricular activities, or the influence of digital resources, are not considered, which may limit the depth of understanding regarding borrowing behaviors. By

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acknowledging these limitations, future research can better address these gaps and build upon this study's findings.

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