

The Challenge of Procrastination: Gaining Insights from Overdue Books in University Libraries

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Abstract

Procrastination is a widespread issue. The late return of library books is a manifestation of procrastination, resulting in fines that impact the overall user experience at the library. Overdue or lost books can disrupt the library's circulation services and affect the satisfaction of other patrons' book needs. This study analyzes overdue readers at Nanjing Normal University Library from 2012 to 2023, examining factors such as the frequency of overdue incidents, borrowing habits, instances of book loss, duration of overdue periods, and the gender and background of the readers. The findings from path analysis suggest that the accumulation of fines is a deterrent for overdue behavior by influencing borrowing habits and serving as a warning against procrastination. Additionally, the study observes the application of the law of large numbers to the occurrence of book overdue, with a weak correlation between overdue incidents and instances of book loss.

Keywords: Procrastination, Library, Overdue, Fines, Path Analysis

1. Introduction

Managing coursework across multiple classes while balancing personal, cultural, and financial obligations can be challenging for university students. Effective time management promotes academic success and maintains good mental health [1]. However, many students struggle with procrastination, which often leads to cramming right before deadlines [2]. Such behavior may indicate a lack of self-regulation [3]. For instance, students may postpone eating until the cafeteria is about to close or procrastinate studying and other planned activities until bedtime. Every year, tens of thousands of overdue and lost book records in Nanjing Normal University (NNU) libraries underscore the growing concern about procrastination among pre-service teachers and students.

According to research on academic procrastination among pre-service teachers, self-regulated online learning significantly mediates the relationship between learning support and procrastination. Students who engage in self-regulated online learning tend to procrastinate less [4]. Unfortunately, many pre-service teachers struggle with procrastination, which is linked to lower academic performance and a lack of effective strategies for self-control [5]. The COVID-19 pandemic has only exacerbated

this issue, with nearly 38% of pre-service teachers reporting increased procrastination due to changes in their study habits and time management [6]. Male pre-service teachers and students in certain departments, such as Literature, may be more prone to procrastination [7].

Many pre-service teachers and students at NNU tend to procrastinate when returning library books. The library has specific deadlines for different types of books and readers, and overdue books are subject to fines based on the number of days they are late. Additionally, there are guidelines in place for compensating missing or irretrievable volumes. It begs the question, do these fines discourage borrowing and reading books, or do they act as a deterrent against procrastination? Is the fine a mediator between book return and borrowing behavior? Such issues arise due to people's risk connection and whether they trust or mistrust a risky object. If something is deemed dangerous, it may be attacked or disregarded due to mistrust.

It is important to address these findings as Onwuegbuzie and Jiao uncovered a link between library anxiety and research performance, which can be influenced by factors such as

age, grade point average, learning style, and procrastination. Academic procrastination is positively associated with certain aspects of library anxiety, including affective barriers, comfort with the library, and mechanical barriers. Furthermore, fear of failure and task aversiveness contribute significantly to academic procrastination and related barriers such as staff interactions, affective barriers, comfort with the library, and knowledge of the library [8,9]. Research on postponed books can broaden the scope of procrastination studies and exacerbate academic procrastination.

2. Previous Research

Research on procrastination continues to grow without reaching a consolidation or maturity in the pattern. Country-wise analysis indicates that the USA leads in this area, followed by Germany, China, and Canada. On the other hand, sufficient discourse and literature exist on procrastination, bedtime procrastination, academic procrastination, and related areas, as explained by Sharma and Kulshreshtha [10]. Recent studies suggest that several factors, including procrastination behavior, academic burnout, self-control, fear of missing out, social anxiety, and self-esteem, have a direct impact on smartphone addiction [11]. On the other hand, problematic smartphone use is linked to sleep procrastination [12]. A reciprocal relationship exists among college students between problematic smartphone use and later bedtime procrastination, each positively predicting the other [13]. Additionally, smartphone addiction has been associated with physical health problems such as sleep disorders and musculoskeletal and neurological issues, as well as negative impacts on academic performance, impulsivity, self-esteem, reduced social interaction, solitude, and even suicide [14]. It is worth noting that during the current COVID-19 pandemic, female students have shown significantly higher levels of smartphone use duration, physical activity, BMI, depression, anxiety, and insomnia severity compared to their male counterparts [15].

Research conducted by Yuan et al. in 2024 has shown that delaying sleep and putting off bedtime can result in sleep disturbances. This trend, commonly referred to as bedtime procrastination, is prevalent among various social groups, notably students, as observed by Herzog-Krzywoszanska et al. in 2021 [16]. Studies have indicated that poor sleep quality is a significant concern amongst Chinese undergraduates, and factors such as education level [17], age, and bedtime procrastination can serve as predictors. As Ma et al. found in 2022, bedtime procrastination is a unique factor contributing to poor sleep quality. Additionally, both rumination and bedtime procrastination play crucial roles in the relationship between internet addiction and poor sleep quality. According to You et al., in 2021, their combined impact was just as significant as either factor [18]. Finally, research conducted by Geng et al. in 2021 suggests that self-control can act as a protective factor against bedtime procrastination, depression, and anxiety, particularly among individuals with smartphone addiction [19].

Social networks can pose a significant obstacle in various areas of life, especially in academia. Studies conducted by Suárez-Perdomo et al. reveal that excessive usage of these platforms can

fuel procrastination tendencies, ultimately impeding students' academic performance [20]. Kurker and Surucu's research further suggests that social media addiction plays a partial role in mediating the relationship between university students' basic psychological needs and academic procrastination [21]. While satisfying basic psychological needs directly leads to a reduction in academic procrastination, it is indirectly associated with a further decrease in social media addiction. Additionally, Hammad and Awed (2023) discovered that students who spend more than four hours daily on social media are more likely to experience psychological alienation and academic procrastination than those who use these platforms for less than two hours [22].

Academic procrastination is a well-researched topic, as it is a complex and diverse behavior that occurs in academic settings. It involves postponing or avoiding academic tasks and has been associated with self-regulation, forgetfulness, and intellectual dogmatism [23]. This behavior hinders the cyclical process of self-regulation in learning, impeding the flow of actions necessary to achieve academic goals and sub-goals. Academic procrastination is a frequent occurrence and has been linked to decreased student performance, as well as a decline in psychological and physical well-being [24]. According to Tao et al., the most prevalent areas of academic procrastination include self-regulation, academic performance, and motivation [25]. The relationship between personal standards and academic procrastination is complex, with high personal standards and control leading to reduced procrastination [26]. Recent studies have found that physical activity can significantly predict higher levels of self-control and self-efficacy and lower levels of academic procrastination [27]. The main reasons for procrastination include challenges, "bad" perfectionism, disorganization, impulsivity, and reduced self-control [28]. Students' procrastination was found to predict burnout positively and significantly, and academic procrastination was found to correlate positively with surface learning and negatively with deep learning approaches [29].

Research on academic procrastination has focused on medical students, revealing that 29.25% experience academic procrastination. Additionally, 47.9% of medical students reported that moderate academic procrastination levels have caused them significant problems. A negative correlation was found between academic procrastination and academic achievement, with male students and those living in dorms exhibiting higher levels of procrastination compared to females and those living at home [30]. Anxiety was found to have a greater impact on academic procrastination than perfectionism among medical and dental students, suggesting that interventions to reduce anxiety could help improve academic performance [31]. Further research also found that academic emotions mediated procrastination and burnout among medical students, with worries about the learning environment contributing to academic burnout [32]. Recent studies have shown that maladaptive perfectionism, low levels of resilience, and self-efficacy are potential risk factors for academic procrastination among nursing undergraduates [33]. Additionally, research has revealed a significant correlation between Internet

addiction and academic procrastination in nursing students [34]. These findings highlight the importance of addressing these factors in interventions to reduce academic procrastination among nursing students. To address academic procrastination, a positive learning environment and constructive peer pressure should be emphasized, and medical universities could offer courses on medical career-calling education [35]. Finally, clinicians should be aware of the role of emotional intelligence in personality and procrastination and identify risk factors beyond low levels of adaptive personality traits to reduce irrational procrastination and improve academic performance [36].

The COVID-19 pandemic has significantly impacted various academic activities, leading to a sudden and significant change in conditions. One notable effect has been a surge in academic procrastination following the introduction of lockdown measures. Students have reported decreased interest in studying and lower working discipline. The causes behind this heightened procrastination during the lockdown period were attributed to supervisors' reduced monitoring of work progress and lower negative consequences of delaying tasks [37]. Decisional procrastination and self-efficacy have been a primary phenomenon analyzed in university students during the COVID-19 pandemic. Sagone and Indiana found that decisional procrastination was predicted by academic self-efficacy and the intolerance of uncertainty (prospective and inhibitory intolerance) [38]. Moreover, the mediating role of prospective intolerance of uncertainty was confirmed in the relationship between self-efficacy (self-engagement and self-oriented decision-making) and decisional procrastination. In Liu et al.'s study, it was found that there were significant positive correlations between school quarantine time and academic procrastination [39]. School quarantine time did not directly affect academic procrastination, but it positively predicted negative effects and ego depletion. School quarantine time affected the levels of academic procrastination among university students through three indirect paths: the mediating role of negative affect, the mediating role of ego depletion, and the chain mediating role of both negative affect and ego depletion. In Xu et al.'s study, loneliness correlated positively with bedtime procrastination [40]. COVID-19 risk perception mediated the impact of loneliness on bedtime procrastination, while self-regulatory fatigue mediated the effect of loneliness on bedtime procrastination. COVID-19 risk perception and self-regulatory fatigue also mediated the effect between loneliness and bedtime procrastination. Furthermore, connectedness to nature mediated the impact of COVID-19 risk perception on self-regulatory fatigue. Reivan Ortiz et al. found that the risk of suffering perceived stress during the COVID-19 pandemic was higher for single women who have lived longer in social isolation, have poor emotional regulation, and have high rates of procrastination [41].

While procrastination has been extensively studied in mobile phone use, internet addiction, and sleep patterns, there is a dearth of research on procrastination about overdue and lost books, which are subject to strict time constraints and constitute a significant form of academic procrastination at university campuses. Understanding

procrastination is crucial in educational psychology as it helps assess and evaluate students' comprehensive quality. However, conventional approaches to procrastination analysis predominantly rely on the expertise and knowledge of domain professionals. Fortunately, the rapid advancement of college information systems has resulted in the capture of many student behavior records, allowing for quantitative analysis of student behavior [42]. This study aims to establish a mutual constraint relationship between the number of times readers exceed the deadline, borrow or lose books, and accumulate fines. Additionally, we strive to comprehend the time frame within which readers exceed the deadline for returning books, examine the impact of COVID-19 on book overdue, and determine the probability of overdue books for different types of readers. This proposed study investigates the contributing factors to overdue or lost library books.

3. Theoretical Foundation

Their intuitive and analytical thinking processes influence people's understanding and application of the law of large numbers. While individuals may grasp the concept that outcomes even out over large samples, they often struggle to apply this principle in practice due to intuitive biases. Specifically, there is a tendency to inhibit the correct application of this law in certain scenarios, requiring analytical thought to override intuition [43]. Moreover, there is a general inclination to associate chance with negative outcomes (e.g., bad luck) rather than positive ones [44]. This bias leads to a reluctance to relinquish control for the potential benefits of randomness, as exemplified by the notion that borrowing more books increases the risk of accruing overdue ones. This reflects a broader hesitance to engage in behaviors that, while beneficial on average due to the law of large numbers, are perceived as risky due to potential negative short-term outcomes.

The motivations behind academics engaging in external activities are multifaceted in the contemporary academic discourse. According to Atta-Owusu and Fitjar, these motivations can be broadly categorized into pursuing external resources for research enhancement, a prosocial desire to contribute to societal well-being, and acquiring monetary benefits [45]. Concurrently, universities' approach toward incentivizing such external engagement varies, indicating a complex interplay between individual motivations and institutional policies. University libraries all across the world routinely impose fines for overdue and lost books. The amount that a library customer must pay to keep a book or other item they have borrowed past the time that they were permitted to do so is known as an overdue fine [46]. The purpose of overdue and lost fines is to motivate readers to return checked books on time and handle borrowed books correctly.

The valuation of tasks, influenced by their perceived importance, affects procrastination behaviors. In a study by Olsen et al., participants tended to discount less important assignments more steeply than important ones [47]. This finding provides insight into how task significance influences motivational priorities and decision-making processes. The allocation of scarce resources, such as time, money, or energy, towards achieving

positive outcomes is a fundamental decision-making challenge. Individuals often weigh the benefits of such investments against the potential for reducing negative outcomes. For instance, a student contemplating additional study hours to enhance exam performance exemplifies this cost-benefit analysis. The focus on relative reductions in adverse outcomes underscores the strategic considerations underlying such decisions [48].

The relationship between cognitive effort and perceived benefits is critical in determining engagement in demanding tasks. Devine and Otto posit that individuals avoid tasks requiring significant cognitive effort unless the anticipated benefits justify the effort, suggesting that a cost-benefit analysis underpins much of human behavior. The notion that monetary rewards and punishments can significantly influence behavior is supported by empirical evidence [49]. Li et al. observed that introducing financial incentives or penalties led to a noticeable improvement in task performance and checking behavior, compared to a control group with no such consequences [50]. This is further corroborated by Brooks et al. and Cannito et al., who found that the prospect of monetary loss exerts a greater motivational force than the potential for gains, highlighting a general aversion to loss over the pursuit of rewards [51-52]. The dynamics of error processing and behavioral adjustment in the context of procrastination are intriguing. Michałowski et al. identified that emotionally negative contexts may exacerbate error-processing deficits in procrastinators, reducing performance and intensifying negative emotions, entrenching a vicious cycle of procrastination and underperformance. The aforementioned studies underscore human behavior's complexity in academic and financial contexts, highlighting the influence of external incentives, psychological factors, and institutional policies in shaping avenues for book overdue exploration [53].

Jean Piaget's pioneering work in the 1930s on the moral cognitive development of children laid a foundational framework for understanding the evolution of moral reasoning from a developmental perspective. His research, employing dual stories and psychoanalytic projection principles, delineated a transition from heteronomous morality to autonomous morality around the age of ten. According to Piaget, younger children's moral judgments are predominantly influenced by external standards set by authority figures, a stage he termed heteronomous morality. As children mature, they begin to rely more on internal standards or self-discipline morality, marking the shift to autonomous moral reasoning. This shift is crucial for educational strategies, as it underscores the importance of aligning developmental levels with appropriate instructional methods [54]. The educational environment, with its myriad rules, plays a significant role in shaping students' moral development. White observes that students, governed by various school regulations, generally choose to comply with them [55]. This compliance is often viewed through lenses of social exchange or power dynamics highlighting the complex interplay between individual moral development and institutional structures.

Circulation policies dictate borrowing and renewal guidelines and

penalties for late, misplaced, or damaged items [56]. The concept of universality in moral philosophy, emerging in the early Modern period, posits that moral notions are omnipresent and that all individuals, as moral subjects, are capable of competent moral judgment without external guidance. This idea, emphasizing moral equality, challenges the need for authoritative moral instruction [57]. Otherwise, complaints from other students at the time showed that they felt resentful and inconvenienced by the other student's disregard for their desire to keep a textbook they all wanted to use [58]. Artemyeva further elaborates on the implications of moral universality, highlighting the importance of impartiality in moral philosophy and decision-making. This includes an impartial stance towards principles of justice and equality and a benevolent attitude towards the common good [59]. Contemporary research by Zhunusbekova et al. on ethical behaviors among pre-service teachers aligns with this perspective, identifying a spectrum of ethical and unethical behaviors within the professional context [60]. These widely accepted or uncontested principles underscore the foundational role of universal moral principles in guiding ethical behavior.

In sociology, morality is analyzed within the broader framework of social relations, focusing on the empirical examination of moral phenomena such as justice, duty, and conscience in social contexts [61]. This perspective emphasizes the societal dimension of morality, exploring how moral norms and behaviors are embedded and enacted within social systems. Overdue library books illustrate the intersection of ethical behavior and societal norms, where the failure to return books on time breaches library rules and disrupts the communal borrowing system. This scenario underscores the role of moral self-restraint, alongside punitive measures like fines, in fostering responsible behavior within shared community resources.

Bayesian theory, rooted in the principles of probability, offers a robust alternative to frequentist methods, particularly in scenarios requiring insights into conditional probabilities. This theoretical approach underscores the importance of prior knowledge in shaping posterior probabilities, thereby enhancing the decision-making process under uncertainty. Furthermore, temporal discounting, which describes how people value rewards less as the delay to their receipt increases, exhibits a magnitude effect; larger delayed rewards are discounted less steeply than smaller ones. This phenomenon has profound implications for understanding human behavior in contexts requiring delayed gratification.

Procrastination extends beyond academic or task-related contexts, affecting behaviors like returning borrowed books. Individuals with a propensity for procrastination experience a compounded effect, leading to overdue returns and an increased likelihood of book loss. This observation underscores the broader implications of procrastination on personal responsibility and resource management. The interplay between statistical theories, psychological constructs, and decision-making processes offers rich insights into procrastination behavior in the library.

4. Research Hypotheses

The study is rooted in the law of truly huge numbers, which suggests that even events with extremely low probabilities, such as overdue and lost books, are almost certain to occur, provided there are enough opportunities. The researcher proposes five hypotheses that explore the relationship between various factors and the occurrence of overdue and lost books.

The First Hypothesis (H1) Proposes that the Number of Overdue and Lost Books Increases with the Number of Books Borrowed. This hypothesis is based on the combination rule, which suggests that as the number of elements increases, the number of interacting element combinations will also rise. The researcher believes borrowers who take out more books are more likely to lose or forget to return them, leading to more overdue or lost books.

The Second Hypothesis (H2) Suggests that Fewer Overdue and Lost Books will Increase as Past Accumulative Fines Increase. This hypothesis is based on the belief that financial cues can impact people's motivations, thoughts, and actions. The activation of money can cause individuals to adopt a market pricing mindset, which involves employing cost and benefit analysis when a book is overdue or lost and focusing on one's gain and loss. The researcher believes that the fear of accumulating fines will motivate borrowers to return books on time, thus reducing the number of overdue or lost books.

The Third Hypothesis (H3) Posits that Self-Discipline Impacts Book Return. This hypothesis is based on the idea that most readers view circulation policies as a form of discipline and return books on time. The ability to critically reflect on one's moral beliefs and feelings and those of others is known as meta-moral cognition. The researcher believes that borrowers with high levels of self-discipline are more likely to return books on time, leading to fewer overdue or lost books.

The Fourth Hypothesis (H4) Proposes that Each Book has an Equal Chance of Being Overdue. This hypothesis is based on the rule of necessity, which posits that if every event that might happen is listed, at least one of them will come true. Borrowers have no idea whether a book will expire or be misplaced before borrowing it, much like a coin flip. The researcher believes each book has an equal chance of being overdue or lost, regardless of its previous circulation history.

The Fifth and Final Hypothesis (H5) Suggests a Correlation Between Overdue and Lost Books. This hypothesis is based on the reality that although book loss incidents are unlikely, they still occur. The researcher believes that unexpected events are expected from a sequence of laws that interact to explain very improbable situations. As such, overdue books might indicate a higher likelihood of lost books and vice versa. By exploring the aforementioned hypotheses, the researcher provides insights into libraries' strategies to improve circulation policies and reduce the number of overdue or lost books.

5. Data and Method

This academic research paper employs 46,238 overdue readers from the NNU Library from 2012 to 2023. The study employs multiple analytical tools, including Excel, SPSS, and SPSS AMOS, while utilizing various analytical techniques, such as Pearson correlation analysis, binary test, path analysis, factor analysis, structural equation model, and binary logistic regression. **Firstly**, the researcher separates the number of overdue returns from the total borrowing times of readers and books each year, calculating the ratio of overdue times to borrowing times, where overdue times are less than or equal to borrowing times. The study visualizes the distribution of the overdue ratio of readers and books by drawing ratio box charts. **Secondly**, the researcher separates the number of readers with and without overdue records each year, calculating the ratio of readers with overdue records to those without. The study draws a scatter plot with 2-period moving average lines to understand the trend of overdue and timely book returns before and after COVID-19. Another scatter plot is drawn with an average ratio line to understand the impact of COVID-19 on book returns. **Thirdly**, the researcher conducts Pearson correlation analysis to determine the correlation coefficient between the book overdue times, book borrowing (including renewal) times, and book loss times for readers. **Fourthly**, the researcher calculates the cumulative overdue fines for the following intervals: 1 - 10, 11 - 20, 21 - 30, 31 - 40, 41 - 50, 51 - 60, 61 - 70, 71 - 80, 81 - 90, 91 - 100, 101 - 110, 111 - 120, 121 - 130, 131 - 140, and for those above 141, at intervals of ten. Additionally, the study calculates the cumulative book loss fines for 1 - 3, 4 - 6, and 7 - 9 at three intervals since the maximum number of overdue readers who lose books is nine. A path analysis graph is created using SPSS AMOS to non-recursively analyze the relationship between cumulative fines (book overdue and book loss), overdue times, lost times, and borrow times of readers. Standardized estimates and squared multiple correlations are selected as two types of outputs.

Fifthly, the researcher tracks the number of days each overdue book is borrowed, ranks the frequency of borrowing days for readers in descending order, and identifies the top 10 days with the highest frequency annually. A scatter plot is generated to gauge readers' attitudes towards overdue books based on their borrowing deadlines. Overdue days are analyzed using box plots to determine their distribution.

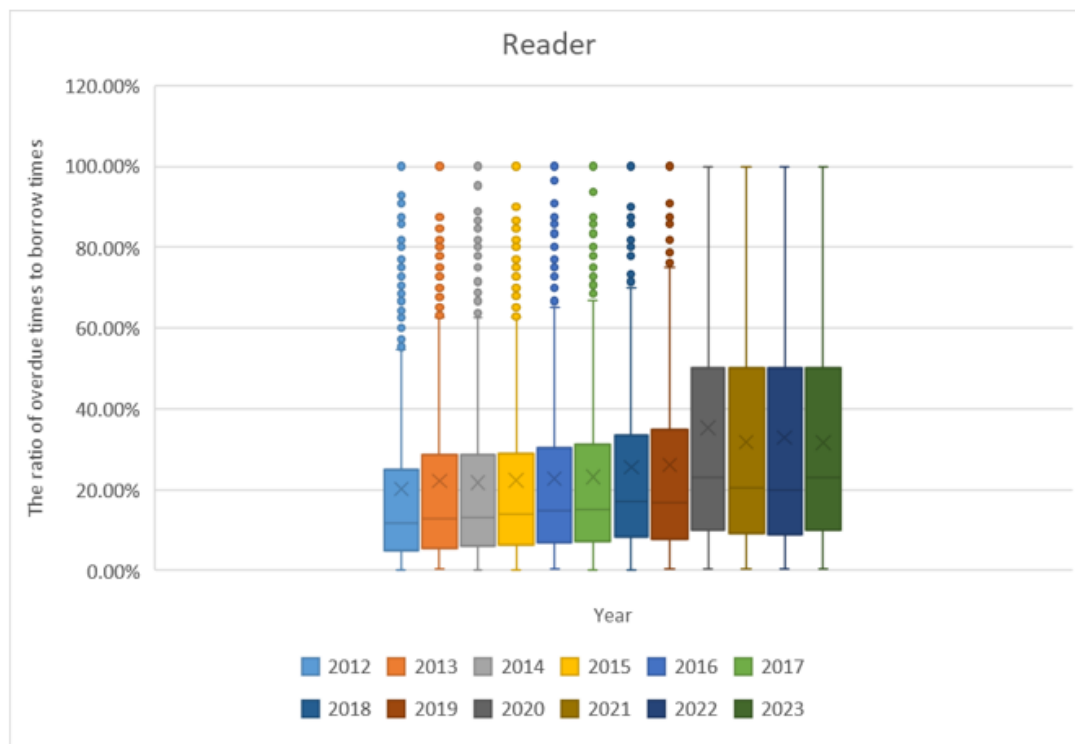
Sixthly, the researcher groups readers based on the total number of overdue times in intervals of 5. The study calculates the average number of overdue times and on-time returns for each group of 1 - 5, 6 - 10, 11 - 15, 16 - 20, and 21 or more times. Then, the number of overdue books is divided into separate groups based on intervals of 1, and the study calculates the average number of overdue times for each group, such as 1, 2, 3, and 4 or more times, as well as the average on-time return for each group. Finally, a binomial test is performed on the mean number of overdue times and the mean on-time returns to estimate whether the probability of their occurrence is equal.

Lastly, the researcher assigns category values to 46,238 readers with overdue book records from 2012 to 2023. This includes information on the gender of the reader (male 0, female 1), whether or not they have lost a book (no 0, yes 1) if they are a faculty member (no 0, yes 1), a graduate student (no 0, yes 1), or an undergraduate student (no 0, yes 1). A binary logistic regression analysis, with the loss of books as the dependent variable and gender, faculty members, postgraduate students, and undergraduate students as independent variables, is utilized to analyze the relationship between the two categorical variables.

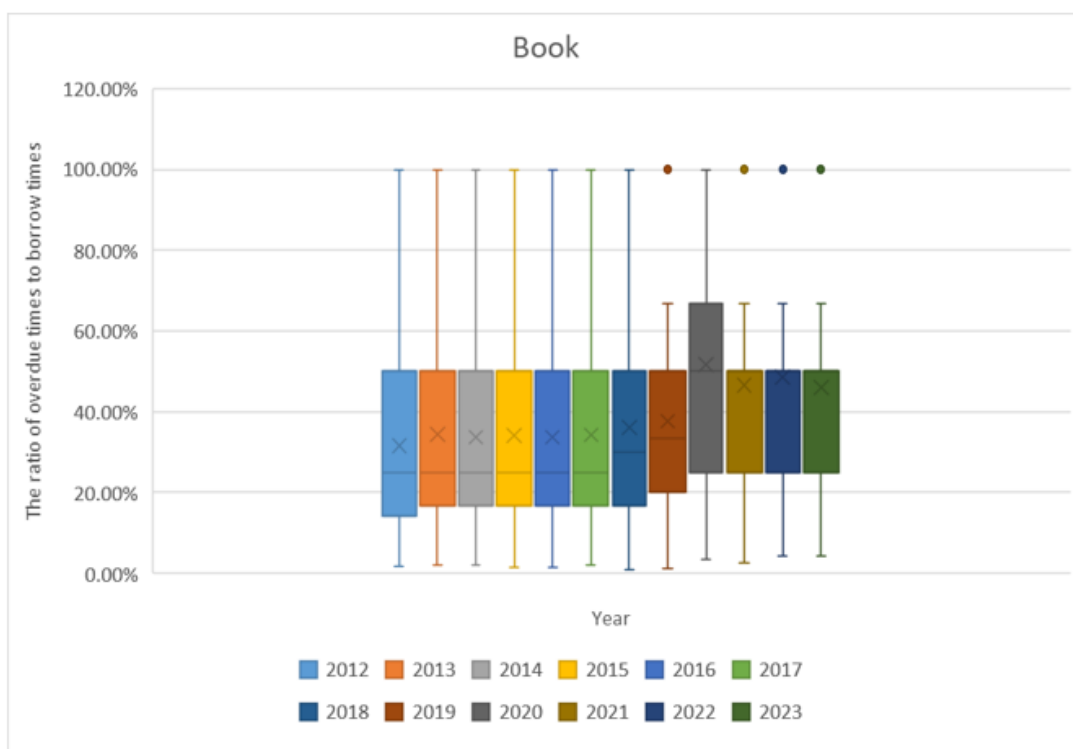
6. Result

6.1 The Correlation Between Overdue Times and Borrow Times Of Readers

A significant correlation (at the 0.01 level) exists between readers' overdue times and borrowing times, with a Pearson correlation coefficient of 0.609. Figure 1 (a) displays the distribution of the ratio of overdue times to borrowing times. From 2012 to the early outbreak of the pandemic in 2019, a ratio exceeding the threshold of 54.55% to 75% is considered an outlier, with a mean range of 20.14% to 26.12% and a median range of 11.54% to 16.67%. However, after the epidemic outbreak, the ratio increased significantly, and 100% of the data became the upper limit, with no outliers. The mean range was 31.63% to 35.28%, and the median range was 20.45% to 23.08%.



(a)



(b)

Figure 1: The Ratio of Overdue Times to Borrow Times.

		Reader overdue times				
		1-5	6-10	11-15	16-20	≥21
2012	Mean of overdue	2	7	13	17	26
	Mean of punctual	34	54	71	77	107
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2013	Mean of overdue	2	7	13	18	27
	Mean of punctual	32	55	74	84	112
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2014	Mean of overdue	2	8	13	18	27
	Mean of punctual	30	54	78	88	109
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2015	Mean of overdue	2	8	13	18	27
	Mean of punctual	28	53	75	86	115
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2016	Mean of overdue	2	7	13	18	28
	Mean of punctual	28	52	75	82	109
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2017	Mean of overdue	2	7	13	18	29
	Mean of punctual	15	41	67	82	114
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2018	Mean of overdue	2	8	13	18	29

	Mean of punctual	14	42	61	70	107
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2019	Mean of overdue	2	8	13	18	30
	Mean of punctual	11	45	71	72	114
	Exact Sig. (2-tailed)	0.02	0.00	0.00	0.00	0.00
2020	Mean of overdue	2	8	13	18	27
	Mean of punctual	15	30	49	58	71
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2021	Mean of overdue	2	7	13	18	30
	Mean of punctual	16	37	52	54	86
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00
2022	Mean of overdue	2	7	12	18	29
	Mean of punctual	10	33	51	70	98
	Exact Sig. (2-tailed)	0.04	0.00	0.00	0.00	0.00
2023	Mean of overdue	2	7	13	18	31
	Mean of punctual	14	29	31	54	81
	Exact Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00

Note: Test Prop.0.50, Exact Sig. (2-tailed) < 0.05.

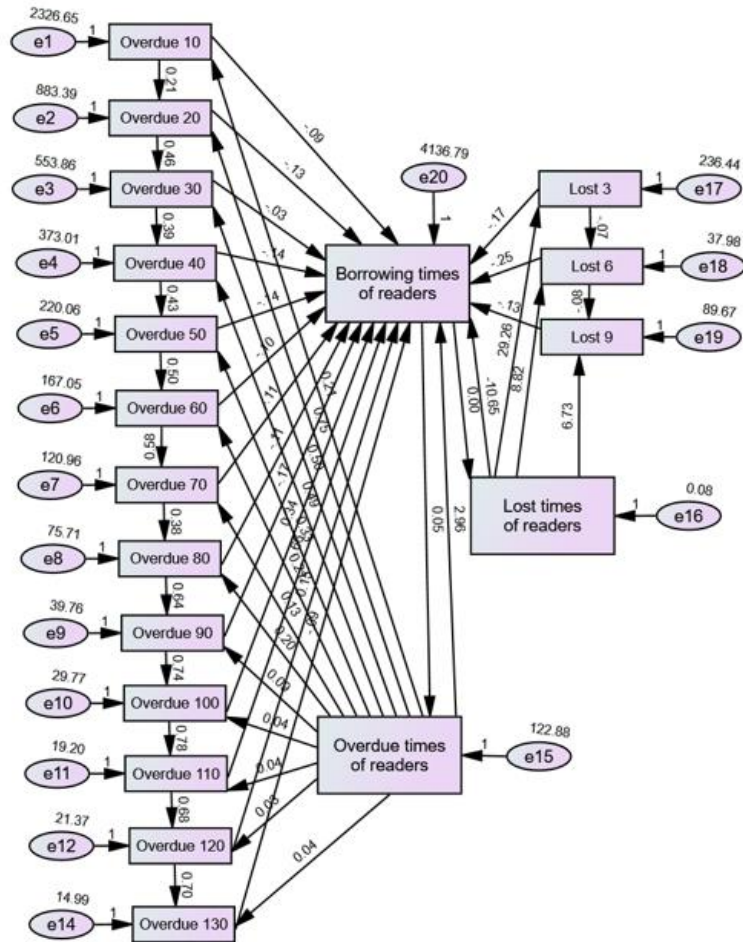
Table 1: Binomial Test of Overdue Times of Readers

Table 1 indicates that as the grouping level increases, the average overdue and on-time returns show an upward trend. This suggests that the higher the borrowing frequency, the higher the likelihood of readers exceeding the deadline. Additionally, it is important to note that the probability of exceeding the deadline and being on time is not equal for readers.

6.2 The Inhibition of Cumulative Fines on the Book Borrowing

Accumulated fines directly inhibit borrowing times, as most standardized regression weights estimate values are negative. The impact of overdue times on borrowing times is higher than that of borrowing times on overdue times because its estimated value is higher. Figure 2 and Table 3 present the path analysis results and

standardized regression weights of readers' cumulative overdue fines, cumulative book loss compensation, overdue times, borrow times, and lost times. Path analysis finds that cumulative overdue fines of more than 21 are reasonable as independent variables, with squared multiple correlations estimate values greater than 0.33. Particularly, the cumulative overdue fines for 101 - 110 and 121 - 130 have excellent estimate values greater than 0.67. In contrast, the cumulative fines for lost books from 3 to 6 and 7 to 9, as well as the cumulative overdue fines from 1 to 10 and 11 to 20, and the book lost times of readers, do not qualify as independent variables, as their estimates values are all less than 0.19. Readers who have defaulted more than 130 are located at the end of the long tail, with a high outlier value that is discarded in path planning.



Squared Multiple Correlations	
Overdue 110	0.746
Overdue 130	0.671
Overdue 100	0.661
Overdue 120	0.631
Overdue 90	0.598
Overdue 70	0.481
Overdue 60	0.425
Overdue 50	0.422
Overdue 80	0.401
Overdue 40	0.370
Overdue 30	0.369
Borrowing times of readers	0.332
Overdue times of readers	0.273
Lost 3	0.216
Overdue 20	0.179
Lost 6	0.109
Lost 9	0.034
Lost times of readers	0.008
Overdue 10	0.000

Figure 2: Accumulated Fines Impact Path Analysis

		Book Overdue times			
		1	2	3	≥4
2012	Mean of overdue	1	2	3	4
	Mean of punctual	4	7	8	13
	Exact Sig. (2-tailed)	0.38	0.18	0.23	0.05
2013	Mean of overdue	1	2	3	4
	Mean of punctual	4	6	8	11
	Exact Sig. (2-tailed)	0.38	0.29	0.23	0.12
2014	Mean of overdue	1	2	3	4
	Mean of punctual	4	6	9	11
	Exact Sig. (2-tailed)	0.38	0.29	0.15	0.12
2015	Mean of overdue	1	2	3	4
	Mean of punctual	4	7	8	12
	Exact Sig. (2-tailed)	0.38	0.18	0.23	0.08
2016	Mean of overdue	1	2	3	4
	Mean of punctual	4	7	8	11
	Exact Sig. (2-tailed)	0.38	0.18	0.23	0.12
2017	Mean of overdue	1	2	3	4
	Mean of punctual	4	6	8	10
	Exact Sig. (2-tailed)	0.38	0.29	0.23	0.18
2018	Mean of overdue	1	2	3	4
	Mean of punctual	3	6	7	9
	Exact Sig. (2-tailed)	0.63	0.29	0.23	0.27
2019	Mean of overdue	1	2	3	4
	Mean of punctual	3	5	6	6
	Exact Sig. (2-tailed)	0.63	0.45	0.51	0.75
2020	Mean of overdue	1	2	3	4
	Mean of punctual	2	3	4	12
	Exact Sig. (2-tailed)	1.00	1.00	1.00	0.14
2021	Mean of overdue	1	2	3	4
	Mean of punctual	2	4	4	6
	Exact Sig. (2-tailed)	1.00	0.69	1.00	0.75
2022	Mean of overdue	1	2	3	4
	Mean of punctual	2	3	4	8
	Exact Sig. (2-tailed)	1.00	1.00	1.00	0.58
2023	Mean of overdue	1	2	3	4
	Mean of punctual	2	4	5	7
	Exact Sig. (2-tailed)	1.00	0.69	0.73	0.55

Note: Test Prop.0.50, Exact Sig. (2-tailed) ≥0.05.

Table 2: Binomial Test of Overdue Times of Books

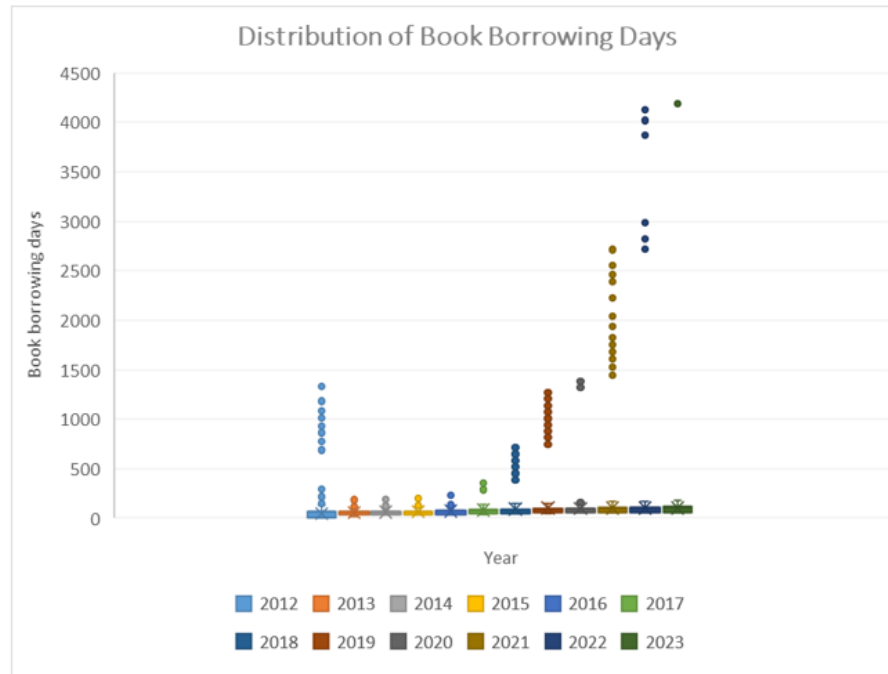
			Estimate				Estimate
BTR	<---	10	-0.055	3	<---	LTR	0.470
BTR	<---	20	-0.054	6	<---	LTR	0.377
BTR	<---	30	-0.012	9	<---	LTR	0.195
BTR	<---	40	-0.044	90	<---	OTR	0.120
BTR	<---	50	-0.035	80	<---	OTR	0.235
BTR	<---	60	-0.021	BTR	<---	OTR	0.489
BTR	<---	70	-0.022	OTR	<---	BTR	0.296
BTR	<---	80	-0.016	LTR	<---	BTR	0.186
BTR	<---	90	-0.022	BTR	<---	LTR	-0.038
BTR	<---	100	0.041	20	<---	10	0.315
BTR	<---	110	-0.073	30	<---	20	0.513
BTR	<---	120	0.014	40	<---	30	0.478
BTR	<---	130	-0.008	50	<---	40	0.538
10	<---	OTR	0.057	60	<---	50	0.574
20	<---	OTR	0.297	70	<---	60	0.645
30	<---	OTR	0.221	80	<---	70	0.515
40	<---	OTR	0.259	90	<---	80	0.719
50	<---	OTR	0.217	100	<---	90	0.788
60	<---	OTR	0.159	110	<---	100	0.844
70	<---	OTR	0.113	120	<---	110	0.771
100	<---	OTR	0.059	130	<---	120	0.788
110	<---	OTR	0.054	6	<---	3	-0.175
120	<---	OTR	0.057	9	<---	6	-0.056
130	<---	OTR	0.081	BTR Borrowing times of readers OTR Overdue times of readers LTR Lost times of readers			
BTR	<---	3	-0.038				
BTR	<---	6	-0.021				
BTR	<---	9	-0.016				

Table 3: Standardized Regression Weights In Path Analysis

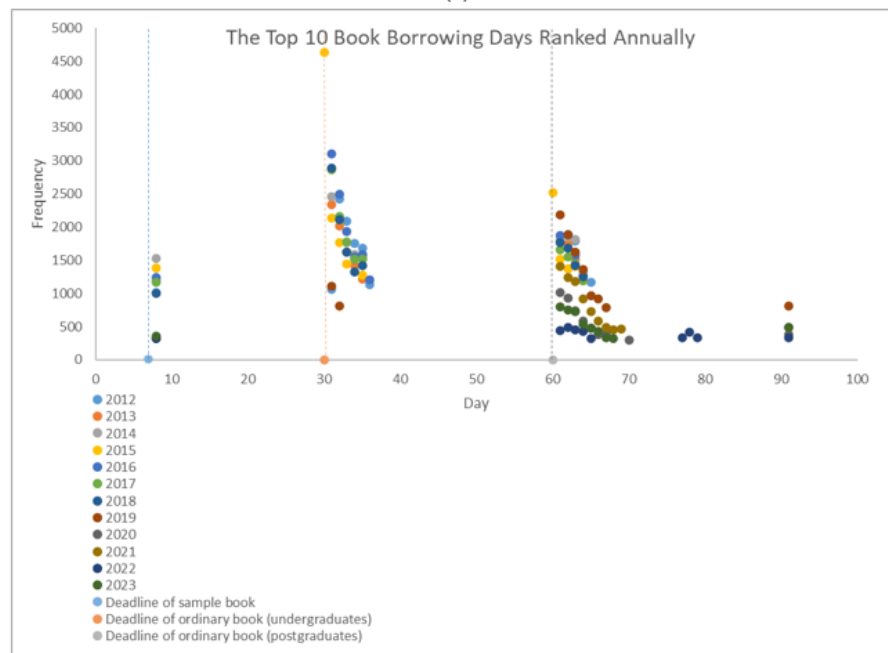
The path analysis reveals that accumulated fines have a direct inhibitory effect on borrowing times, as most standardized regression weights estimate values are negative. Moreover, overdue times have a higher impact on borrowing times than vice versa, as its estimated value is higher.

6.3 Self-Discipline Impact

Figure 3 reveals that the annual top 10 days of book borrowing are concentrated around 31, 61, and 8 days. Generally, readers return books when they realize they are overdue.



(a)

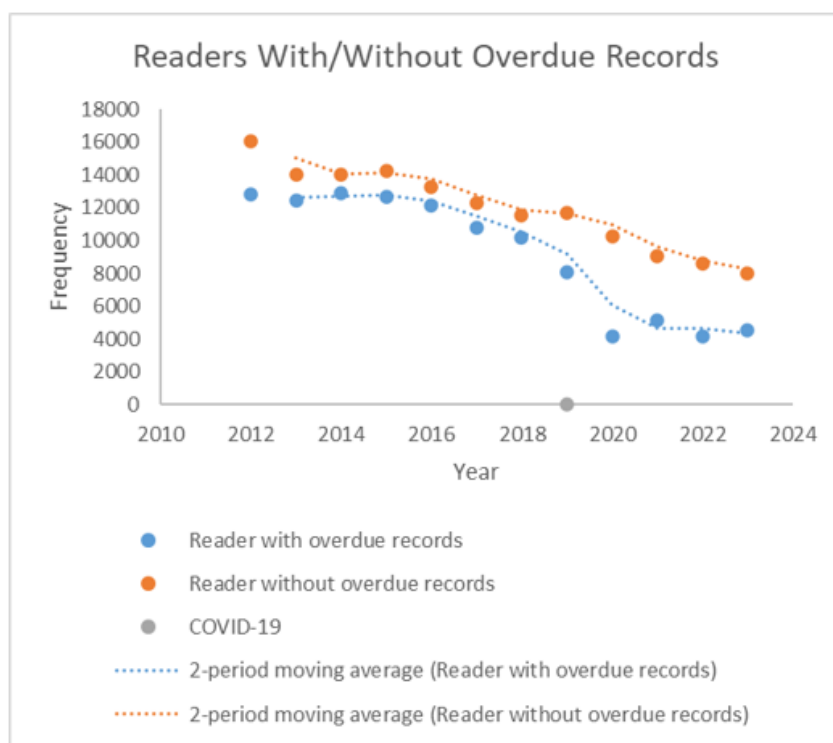


(b)

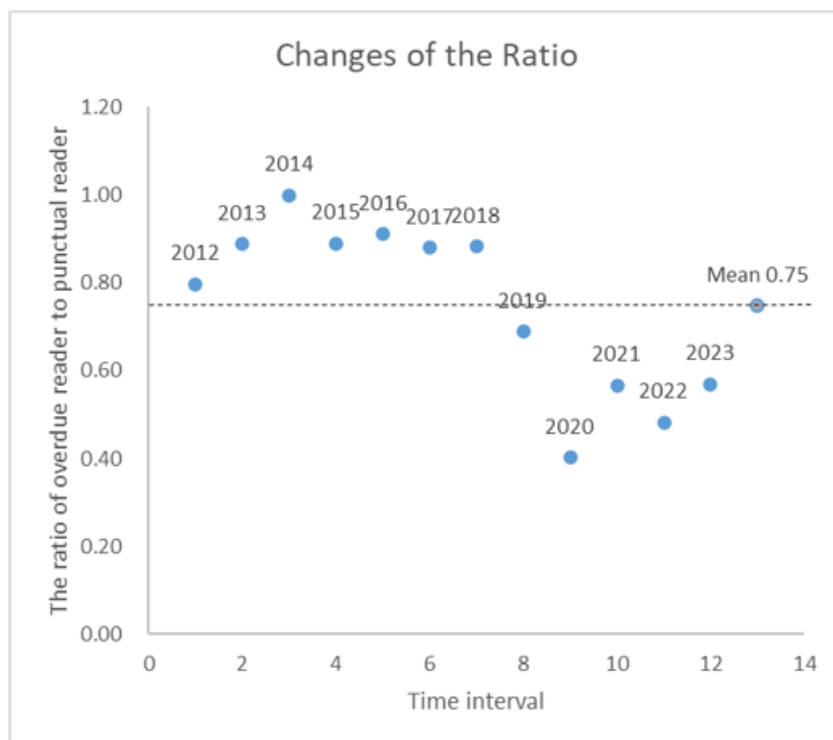
Figure 3: Distribution of Book Borrowing Days and the Top 10 Book Borrowing Days

The COVID-19 outbreak resulted in a lower decline of overdue readers than the 2-period moving average line valuation. The ratio of overdue readers to punctual readers has significantly decreased

since 2019, with both falling below the average line (see Figure 4). This indicates that readers have become more aware of the importance of risk management for overdue books.



(a)



(b)

Figure 4: The Ratio of Readers with Overdue Records and Readers Without Overdue Records

6.4 The Probability of Overdue Returns and On-Time Returns for Each Book

Regarding book returns, it is worth noting that the probability of overdue returns and on-time returns for each book is equal despite the uneven probability for readers. Because Table 2's binomial test of mean shows that $P \geq 0.05$, regardless of the overdue level.

6.5 Correlation Between Book Overdue and Lost

There is a weak correlation between overdue times and lost times of readers, with a Pearson correlation coefficient of 0.12. This correlation is statistically significant at the 0.01 level (2-tailed).

Additionally, the binary logistic regression results in Table 4 reveal that female overdue readers are likelier to lose books than male overdue readers, and faculty members are likelier to lose books than non-faculty members. The regression equation is as follows:
Logit (P) = - 3.287+0.263*Female or not
Logit (P) = - 3.226+0.526*Staff or not

However, there is no significant difference between graduate and non-graduate students and undergraduate and non-undergraduate students.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Female or not	0.263	0.052	25.657	1	0.000	1.300
	Constant	-3.287	0.029	12734.655	1	0.000	0.037
Step 1 ^b	Staff or not	0.526	0.127	17.213	1	0.000	1.692
	Constant	-3.226	0.025	17259.019	1	0.000	0.040
Step 1 ^c	Postgraduate or not	0.009	0.049	0.038	1	0.845	1.010
	Constant	-3.214	0.032	10092.565	1	0.000	0.040
Step 1 ^d	Undergraduate or not	-0.004	0.048	0.006	1	0.939	0.996
	Constant	-3.208	0.034	8677.349	1	0.000	0.040

a.Variable(s) entered on step 1: Female or not.

b.Variable(s) entered on step 1: Staff or not.

c.Variable(s) entered on step 1: Postgraduate or not.

d.Variable(s) entered on step 1: Undergraduate or not.

Table 4: Variables in the Equation

7. Discussion

Based on the findings above, the five hypotheses have been validated. As the number of books borrowed increases, the number of overdue and lost books also increases, but the growth rate of overdue books is slower than that of borrowed books. There is a suppressive effect on readers' enthusiasm to borrow books when there is an increase in overdue cumulative fines and fines for lost books. Borrowing times mediate the relationship between cumulative fines and overdue and lost times of readers. Although there is a positive correlation between borrowing times and overdue/lost times, the relationship between cumulative fines and overdue/lost times depends on the multiplication of the correlation coefficient. Therefore, cumulative fines also have a suppressive effect on readers' overdue times. On average, the probability of each book being overdue or not being overdue is the same. However, category I overdue books have a much higher quantity than other books. There is a weak correlation between overdue times and lost times of readers. Female overdue readers are likelier to lose books than male overdue readers, and faculty members are likelier to lose books than non-faculty members.

College students display a wide range of self-regulated learning behaviors, with some showing exceptional levels while others falling within the average range. However, many students also struggle with academic procrastination. Research has uncovered

a significant negative correlation between self-regulated learning and academic procrastination. Self-regulated learning strongly predicts procrastination among college students [62]. Self-regulated learning encompasses various aspects, including self-regulation, metacognition, motivation, and learning analytics [63]. Hence, evaluating students' self-regulation skills is crucial to identify areas where they may require additional support, particularly in time management skills such as engagement, regularity, and anti-procrastination [64]. Additionally, this study has revealed a new finding that the logical rationality of readers goes against self-regulation after the maximum overdue period. The occurrence of the maximum number of overdue days means that reader procrastination has reached its peak. Under the warning of fines, readers will self-regulate and reduce book borrowing, leading to a suppression of book circulation. For books to be returned on time and avoid being marked as overdue or lost, they must first be discovered and borrowed by readers. Students with a positive attitude towards reading tend to use effective reading strategies more frequently and are less likely to avoid information. The impact of procrastination on the relationship between reading strategies and information avoidance is relatively weak, as is the effect of procrastination and information overload on the connection between reading attitudes and information avoidance [65]. Men have a more negative attitude towards being overdue than women do. Male readers have consistently had a higher

quartile of past-due fines and cost of lost books than female readers in NNU over the past 12 years.

Readers must first find and borrow books, ensure timely return, and avoid overdue or lost status. Those with a positive attitude toward reading tend to employ effective reading techniques more often and are less prone to information avoidance. The influence of procrastination on the correlation between reading strategies and information avoidance is limited, as is the impact of procrastination and information overload on the link between reading attitudes and information avoidance, as per Fuertes et al.'s research [64]. It has been observed that men have a more negative attitude towards overdue than women. It is not always the case that male overdue books are popular books.

There are two types of strategies for dealing with accountability for overdue or lost books: low-cognitive-effort decision-evasion tactics such as buck passing, procrastination, and exiting the situation, or high-cognitive-effort attempts to craft integratively complex compromises among conflicting perspectives [66]. According to Winarso et al., tailoring interventions toward personality traits can enhance their effectiveness in addressing student procrastination [67]. Additionally, Gadosey et al. highlight the importance of positive emotions, such as hope, as protective factors against procrastination [68]. Peixoto et al. suggest that students' harmonious passion for their studies may protect against academic procrastination and mental health issues [69]. Conversely, obsessive passion can increase the risk of procrastination. Talebian et al. emphasize the significance of self-esteem, perceived competence, and self-efficacy in reducing academic procrastination [70]. Furthermore, Carranza Esteban et al. found that academic self-efficacy and procrastination can predict research motivation [71]. Quispilaya-Capcha underscores the negative impact of procrastination on self-efficacy, while Oram and Rogers stress the importance of satisfying basic psychological needs to increase academic motivation and reduce procrastination [72-73]. Kröner and Fritzsche suggest that self-discipline is the most crucial facet of conscientiousness when explaining procrastination [74].

This study emphasizes the challenges that university students face with time management, which can be a major obstacle to their academic success. It highlights the need for a comprehensive approach to address academic procrastination and create a more supportive and effective educational environment. This could include interventions to improve time management skills, build confidence in academic abilities, reduce distractions, and establish practical academic goals to reduce academic procrastination [75]. Additionally, educational programs focused on developing emotional regulation strategies, counseling programs designed to enhance self-confidence, educational effectiveness, responsibility, and stress-coping mechanisms, and psychoeducational programs aimed at fostering skills such as academic self-regulation, time management, organization, and metacognitive strategies could be beneficial [23, 76]. A personalized approach to understanding the root causes of academic procrastination and institutional and

policy-level interventions to support students and improve the academic landscape nationwide are also essential [77,78].

The cumulative data over the past twelve years indicates a consistent uptrend in fines levied for both overdue and lost books across both male and female quartiles. Notably, the second quarter of each year, coinciding with a surge in graduations and a consequent decline in class attendance, marks a significant escalation in fine payments. The book overdue fines paid during this period are observed to be more than double that of other quarters, with penalties for lost books peaking at three to four times higher than in any other quarter. Overdue books are distributed as follows: Sample books constitute approximately 8%, foreign language books 2%, and regular books the remaining 90%. Regarding fine contributions, sample books account for about 24%, foreign language books account for 3%, and regular books account for approximately 73%. The average fine amounts to 13.2 yuan for sample books, 6.8 yuan for foreign language books, and 3.4 yuan for ordinary books. This pattern underscores the need for heightened awareness among the library's incoming freshman class about adhering to book return deadlines.

Furthermore, the data reveals that between 6% and 18% of books are returned late on multiple occasions annually. A focused analysis identifies that 530 books have been overdue more than three times annually over two years, 76 books for three years, and 11 books for four years. Particularly noteworthy is "*Unequal Childhoods: Class, Race, and Family Life*" by Annette Lareau, which has been overdue more than three times annually for five consecutive years. Given the extensive collection of 5 million books in the NNU library, the recurring overdue instances of a single book suggest a pattern that transcends mere chance. This calls for librarians to better communicate the risks of procrastination in book returns, especially in situations requiring quick decision-making.

8. Limitations

This study primarily uses fines for overdue books and the length of book borrowing as indicators to analyze the correlations and influential pathways among different factors contributing to procrastination. The book circulation data and reader registration information provide only a partial depiction of delayed returns, and uncovering latent variables relies on existing field data. Future research will explore social and humanistic factors, such as psychological dispositions, family financial status, educational interventions, and management culture, to address the limitations of this study.

List of Abbreviations

NNU- Nanjing Normal University
BTR- Borrowing Times of Readers
OTR- Overdue Times of Readers
LTR- Lost Times of Readers

Declarations Section

Ethical Approval and Consent to Participate

This research doesn't involve human participants and/or animals and informed consent.

Consent for Publication

The author grants the Publisher an exclusive license to publish the article.

Availability of Supporting Data

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests/Authors' Contributions

The author declares no conflicts of interest pertaining to this research, authorship, or publication.

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