**Reading Less, Connecting Remotely: A Snapshot of Postgraduate Academic Behavior in China During COVID-19**

**Abstract** The outbreak of COVID-19 has forced postgraduate students in China to adapt to new learning environments. This study aimed to investigate the impact of the pandemic on reading habits and communication with academic supervisors among postgraduate students. A survey was conducted among 2298 postgraduate students from different universities across mainland China using an online questionnaire. Data collected included individual student characteristics, study characteristics, book and paper reading habits before and after the epidemic outbreak, and supervisor communication frequency over time. Both book reading and paper reading decreased on average after the COVID-19 outbreak but still displayed a low positive growth rate. In contrast, there was an obvious decrease in supervisor communication frequency when comparing these two measures over time. These findings highlight areas where further support may be needed for effective mentorship/supervision practices going forward during pandemics like COVID-19 that disrupt traditional forms of graduate education. This study provides insights into how graduate education has been impacted by COVID-19 while also emphasizing the need for continued research on effective ways to support postgraduate students during pandemics.

**Keywords:** Reading habit; Mentoring; Graduate education; COVID-19; China

**1. Introduction**

The COVID-19 pandemic has caused significant disruptions to higher education institutions worldwide (Marinoni, 2020; García-Morales, 2021; Bashir et al., 2021; Fernández-Batanero, 2022; UNESCO, 2022), including changes in how teaching and learning are delivered (Lockee, 2021; Pozo, 2021). Graduate programs have not been immune to these changes, with many having to shift from traditional classroom settings towards online-learning formats (Andrade et al, 2023; Spronken-Smith et al., 2022; Lokhtina et al., 2022). This transition has had implications for various aspects of graduate education, including student reading habits and faculty supervision. Over the past few decades, China has seen a major shift in the way graduate education is delivered, with a dramatic increase in the number of students and programs. According to a report from the Ministry of Education of the People’s Republic of China, the number of postgraduate students in China has been increasing rapidly in recent years. In 2022, the total number of graduate students enrolled nationwide was 1,242,500, with 139,000 doctoral students and 1,103,500 master’s students (Ministry of Education of the People's Republic of China, 2023). The increasing number and size of graduate students highlight the growing significance of researching graduate education and graduate education-related research (Shen & Hu, 2021; Tang, 2022).

However, with the shift towards remote learning due to the pandemic comes challenges such as differences in access to resources like libraries as well as reduced opportunities for face-to-face interactions with faculty supervisors (Wang et al., 2022; Shi & Zhang, 2022). These challenges may be particularly acute for Chinese graduate students who typically rely heavily on mentorship relationships during their studies (Zhang et al., 2020). Supervisory support plays an important role in facilitating successful mentorship relationships during graduate study (Kram, 1985). Faculty members who encourage their supervisees to read regularly can help promote intellectual development and academic exploration while also guiding career-related discussions. During times of remote work such as we are currently experiencing due to Covid-19; supervisory support becomes even more crucial given limited physical availability across campuses. Overall, these studies suggest that while technology can aid remote mentoring/supervision it might not always suffice without proper guidance/support structures in place for both parties involved. Postgraduate supervision is a much-explored field and a subject of scrutiny in the West but there is scant empirical research in Asia (Lim, et al., 2016)

Therefore, this study aims at investigating the impact of COVID-19 on both student progress and supervision among Chinese graduate programs specifically. The current research examines whether there have been any changes in reading habits or perceptions related to mentoring relationships since transitioning from traditional classroom settings towards online-learning formats caused by the pandemic. This research seeks not only a better understanding of how these factors influence each other but also provides valuable insights into potential strategies for supporting effective distance learning environments where appropriate levels of educational equity can be maintained despite disruptions resulting from pandemics or other disasters affecting higher education institutions worldwide.

**2. Method**

**2.1 Research Questions**

The current research design aims at investigating how COVID-19 has impacted graduate students’ reading habits as well as their perceptions regarding mentorship relationships in China’s higher education institutions. By collecting data through an online survey conducted among students including Masters and PhD students, we hope to gain valuable insights into potential strategies to support effective distance learning environments where appropriate educational equity can be maintained despite the devastation caused by pandemics or other disasters affecting higher education institutions globally. Consequently, we developed the following research question for the articles:

RQ1. What is the overall profile of postgraduate students in terms of reading books, reading articles and communicating with their supervisors before and after the outbreak?

RQ2. Were there any significant differences in the impact on postgraduate students’ reading of books, reading of articles and communication with their supervisors based on individual students' characteristics (gender, age) and study characteristics (status, form of study, type of study, enrollment year, subject affiliation)?

RQ3. What is the relationship between changes in postgraduate students’ reading of books, reading articles and mentoring by their supervisors during the epidemic?

**2.2 Population and Procedure**

The study recruited 2,298 graduate students from mainland China who were currently studying or enrolled in study-abroad programs. The participants included both masters and doctoral students across various disciplines.

Data were collected using an online survey created with a WeChat form. The survey consisted of questions related to changes in reading habits, supervision, academic progress during the COVID-19 pandemic, and perceptions of mentor relationships. Participants received an electronic link inviting them to participate and provided informed consent before completing the survey. Participants were asked about their reading habits and mentor communication before and during the pandemic, including their weekly reading habits, including whether they read books and articles related to their field of study. They also reported any changes in their supervision as well as academic progress since transitioning to remote learning due to COVID-19.

Finally, participants answered a series of Likert scale questions about their experiences of supervisory support during this period. These questions assessed how often they communicated with their mentor as a result of the epidemic and their perceptions of the overall change in the support provided by their supervisor.

**2.3 Variable and Survey items**

*2.3.1 Independent Variable*

The survey examines the relationship between the individual student and learning characteristics on changes in reading and supervisor monitoring before and after the pandemic. The independent variables in the survey are divided into two main categories: individual student characteristics and student learning characteristics. The individual student characteristics category consists of two items, which include gender (male and female) and age (less than 26, 26-30, and over 30). The student learning characteristics category consists of five items, including the level of study (Master, PhD), the form of study (Full-time, Part-time), the type of study course (Academic, Professional), year of enrollment (before 2017, 2018, 2019, 2020, 2021), and subject affiliation (Humanities & arts, Social science, Nature Science, Engineering, Medicine & nursing). These variables are quantified using multiple-choice questions designed to gather information about the participants’ backgrounds and characteristics.

*2.3.2 Dependent Variable*

This study aims to investigate the impact of the COVID-19 pandemic on graduate students’ reading habits and their mentorship communication. The dependent variables under consideration are changes in the number of books and articles read by graduate students before and after the pandemic, as well as changes in the frequency of meetings with mentors. The questionnaire consists of two pre- and post-pandemic questions related to books, where respondents select from four options ranging from more than 5 books to never read. Similarly, for articles, respondents choose from four response options ranging from more than 5 articles to never read.

In addition, changes in mentorship communication were assessed through two questions that asked about the frequency of meetings before and after the pandemic and provided multiple response options. The questionnaire items asked respondents how often they met with their mentors before and after the pandemic, and response options included once per year, once per semester, once every two to three months, once per month, and others.

Overall, this study provides valuable insights into how graduate students’ reading habits have been affected by the COVID-19 pandemic and how it has impacted their relationships with their mentors.

**2.4 Data analysis**

The data collected through questionnaires will be analyzed using descriptive statistics, specifically mean scores. The statistical software SPSS version 26.0 will be used for this purpose. Inferential statistical tests, such as Paired samples t-test and Paired samples Wilcoxon test, as well as the Kruskal-Wallis H(K) test, will also be employed to analyze the data.

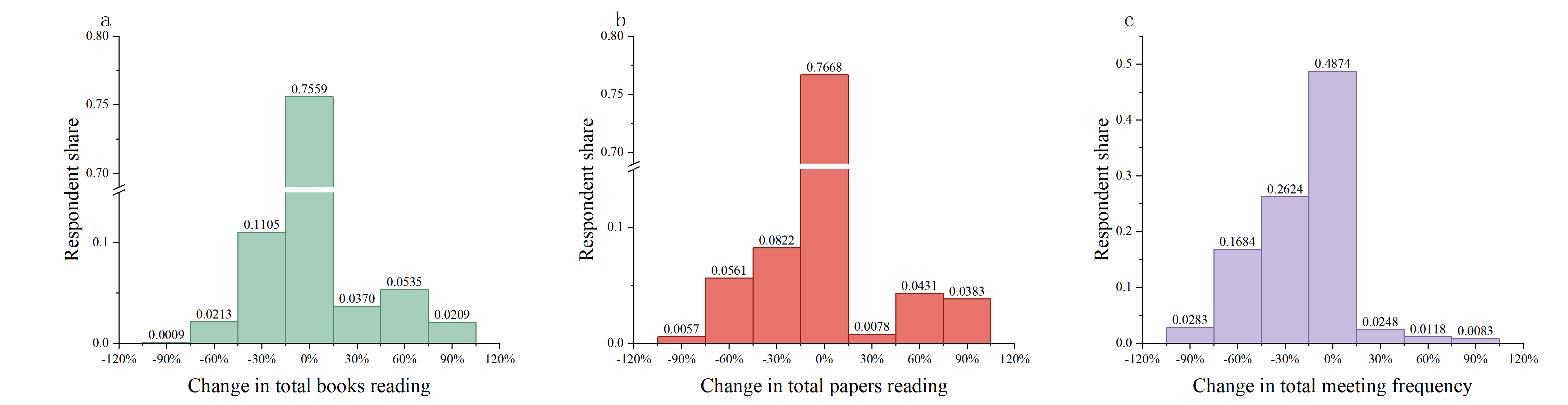
To test hypotheses related to certain variables like frequency of reading (including frequency of books read per month and frequency of papers read per week), and frequency of supervision before and after the pandemic outbreak, Kendall tau\_b correlation analysis will be conducted.

To account for multiple testing, the adjusted significance level will be calculated using the Bonferroni correction method. Pairwise comparison techniques may also be utilized during the data analysis process to increase the reliability and validity of the results obtained from this study.

**3. Results and Findings**

**3.1 Impact on Reading and Supervisor Mentoring Among Graduate Students**

Based on the analysis of the amount of change in the data based on the survey data before and after the epidemic, the degree of change in the variables was defined as（%）. The distribution is plotted as follows.



**Figure 1**. Analysis of the amount of change in book reading, article reading, and supervisor communication before and after the outbreak.

Based on the description in Figure 1a, the study depicted a bar chart and calculated the weighted area. The results showed that among the surveyed population, more than 0% of the total area of bars was greater than less than <0% of the total area of bars, indicating changes in graduates' reading behavior during this particular period. Specifically, among those whose book reading volume remained unchanged before and after the COVID-19 outbreak, they accounted for the highest proportion at 75.6%, while those who decreased their reading volume by over 30% accounted for about 11%, and those who increased their reading volume by over 60% only accounted for 5.4%.

According to the description in Figure 1b, the sum of weighted areas of bars with values greater than 0% is larger than that of bars with values less than <0%, indicating an overall increase in the amount of change. Among those whose book reading volume remained unchanged before and after the COVID-19 outbreak, they accounted for 76.7%. Those who decreased their reading volume by over 30% accounted for about 4.3%, while those who increased their reading volume by over 60% accounted for 8.2%.

According to the description in Figure 1c, the sum of weighted areas of bars with values greater than 0% is smaller than that of bars with values less than <0%, indicating that most groups have reduced communication with their supervisors. Among those who maintained the same frequency of communication with their supervisors before and after the COVID-19 outbreak, they accounted for 48.7%. The proportion of groups whose amount of change was positive was less than 4%, which means that the vast majority experienced a reduction in communication with their supervisors.

Comparing the above charts on changes, both book reading and paper reading decreased after the COVID-19 outbreak average, but their mean change value showed a low positive growth rate. In contrast, there was an obvious decrease in supervisor communication frequency from any perspective when comparing these two measures to supervisor communication frequency over time.

**3.2 Differences in Variables Across Different Factors Between Pre-and Post-Outbreak**

Table 2 describes the results of a statistical analysis of the impact of the COVID-19 outbreak on reading and communication behaviors among graduate students. The survey population was divided into individual characteristics (gender, age) and learning characteristics (level, form of study, etc.), with each group being tested three times using H-tests. The standard deviation for each group represented the degree to which they deviated from the mean under change variables (the smaller the standard deviation, the less difference between pre-and post-outbreak data).

The analysis found that there were no significant differences in book reading change variables across different factors. However, there was a significant difference in the paper reading change variable for age groups (<0.01), with pairwise comparisons indicating significant differences between those over 30 years old compared to those under 26 or aged 26-30.

Regarding the supervisor communication change variable, all factors showed significant differences. Post-hoc tests revealed that there were significant differences between age groups. There were also significant pairwise comparisons between admission time groupings (2018-2021 vs 2019-2020 vs 2019-2021). Finally, many disciplines showed statistically significant differences as well in terms of their supervisor communication changes after the COVID-19 outbreak.

*3.2.1 Comparison of Changes in Paper Reading Among Different Age Groups*

Table 3 shows the statistical analysis results comparing two groups of individuals based on their age. The first row compares participants aged over 30 with those under 26, and the second row compares participants over 30 with those aged between 26-30. Both comparisons indicate significant differences in personal traits after adjusting for multiple testing using Bonferroni correction method (Adjusted p= .001). However, no significant difference was found between the younger age categories (<26 & [26-30]). Therefore, we can conclude that there is a significant difference in paper reading between students over 30 years old and those under 26 or aged 26-30.

**Table 2**. Description of the overall sample (n=2,298) according to three parts (Post-hoc tests)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | N | % | Change in Book Reading | | | Change in Paper Reading | | | Changes in Monitoring | | | |
| 2,298 | 100% | Kruskal-Wallis H(K) / *P*-value / cohen’s*f*  SD | | | | | | | | | |
| Gender |  |  | 0.095 | >0.05 | 0.000 | 0.028 | >0.05 | 0.001 | 23.643 | <0.01 | | 0.003 | |
| Male | 1011 | 43.5% | 0.016 | | | 0.012 | | | -0.078 | | | |
| Female | 1287 | 56.5% | 0.018 | | | 0.027 | | | -0.160 | | | |
| Age groups (years) |  |  | 1.57 | >0.05 | 0.001 | 13.496 | <0.01 | 0.004 | 72.079 | <0.01 | | 0.008 | |
| <26 | 1584 | 68.9% | 0.273 | | | 0.351 | | | 0.475 | | | |
| 26-30 | 524 | 22.8% | 0.261 | | | 0.410 | | | 0.425 | | | |
| >30 | 190 | 8.2% | 0.244 | | | 0.315 | | | 0.332 | | | |
| Level of study |  |  | 0.079 | >0.05 | 0.000 | 3.262 | >0.05 | 0.003 | 4.74 | <0.05 | | 0.001 | |
| Master | 2195 | 95.6% | 0.018 | | | 0.018 | | | -0.125 | | | |
| Ph.d | 103 | 4.4% | 0.011 | | | 0.073 | | | -0.096 | | | |
| Form of study |  |  | 0.588 | >0.05 | 0.002 | 0.707 | >0.05 | 0.000 | 0.401 | <0.01 | | 0.006 | |
| Full-time | 1850 | 80.5% | 0.013 | | | 0.020 | | | -0.091 | | | |
| Part-time | 448 | 19.4% | 0.036 | | | 0.023 | | | -0.261 | | | |
| Type of study |  |  | 0.031 | >0.05 | 0.000 | 2.156 | >0.05 | 0.001 | 12.414 | <0.01 | | 0.001 | |
| Academic | 937 | 40.7% | 0.015 | | | 0.032 | | | -0.110 | | | |
| Professional | 1361 | 59.2% | 0.019 | | | 0.012 | | | -0.133 | | | |
| Admission year |  |  | 4.7 | >0.05 | 0.004 | 6.517 | >0.05 | 0.005 | 46.648 | <0.01 | | 0.006 | |
| <2017 | 43 | 1.8% | -0.025 | | | 0.012 | | | -0.089 | | | |
| 2018 | 77 | 3.3% | -0.014 | | | 0.104 | | | -0.230 | | | |
| 2019 | 501 | 21.8% | 0.033 | | | 0.022 | | | -0.182 | | | |
| 2020 | 833 | 36.2% | 0.021 | | | 0.018 | | | -0.127 | | | |
| 2021 | 844 | 36.7% | 0.009 | | | 0.014 | | | -0.078 | | | |
| Discipline |  |  | 5.521 | >0.05 | 0.004 | 5.461 | >0.05 | 0.004 | 148.094 | <0.01 | | 0.009 | |
| Humanities & arts | 401 | 17.4% | 0.040 | | | 0.041 | | | -0.198 | | | |
| Social science | 752 | 32.7% | -0.001 | | | 0.002 | | | -0.194 | | | |
| Nature science | 77 | 3.3% | -0.009 | | | -0.044 | | | -0.112 | | | |
| Engineering | 953 | 41.4% | 0.027 | | | 0.028 | | | -0.057 | | | |
| Medicine & nursing | 115 | 5.0% | -0.005 | | | 0.043 | | | 0.031 | | | |
| Note: A p-value of less than 0.05 indicates that the results of a statistical test are statistically significant at the 95% confidence level, meaning there is strong evidence to reject the null hypothesis and accept the alternative hypothesis. | | | | | | | | | | |

**Table 3** Pairwise comparison of age groups based on their changes in paper reading

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample 1-Sample 2 | TS | SE | STS | p | Adj. *p*a |
| >30-<26 | 132.325 | 37.738 | 3.506 | .000 | .001 |
| >30-26-30 | 144.938 | 41.626 | 3.482 | .000 | .001 |
| <26-26-30 | -12.613 | 24.771 | -.509 | .611 | 1.000 |

Note: Each row tested the null hypothesis that “the distribution of Sample 1 is not significantly different from that of Sample 2”. The results displayed asymptotic significance (two-tailed test) with a significance level of .05. The adjusted significance level was calculated using Bonferroni correction to account for multiple testing.

*3.2.2 Comparison of Changes in Supervisor Monitoring According to Different Characteristics*

**Table 4** reveals that there were significant differences between individuals aged over 30 compared to those under 26 or aged between 26-30 years old concerning supervision communication patterns (Adjusted pa = .001). However, no significant difference was found between younger age categories (<26 & [26-30]). Regarding admission year group comparisons: a statistically significant difference was observed between participants admitted in 2018 and those admitted in other years except before 2017(adjusted p-value >0.05); interestingly enough participants from different years showed considerable variability among each other as illustrated by some high values of TS such as -253.760 when comparing samples from admission year group “2018” against “2021”. Lastly, discipline group comparison revealed that Humanities & Arts significantly differ from Nature Science (STS=-3.951) and Engineering (STS=-9.165), Social Sciences also differ significantly from Nature Science(STS=-3.336)and Engineering(STS=-9.290), whereas no significant difference was observed within sub-groups belonging to same major categories such as Medicine& Nursing subgroups or engineering-nature science subgroup(p>0.05).

In conclusion, these findings provide valuable insights into how certain factors affect graduate students’ mentorship communication during disruptive events like pandemics; however, a more detailed analysis may be needed for further interpretation of results obtained especially regarding individual majors since it appears that they play an important role in shaping mentoring interactions dynamics inside universities setting but this requires a specific focus on each discipline separately.

**Table 4** Pairwise comparison of changes in supervisor monitoring based on age, admission year and discipline groups

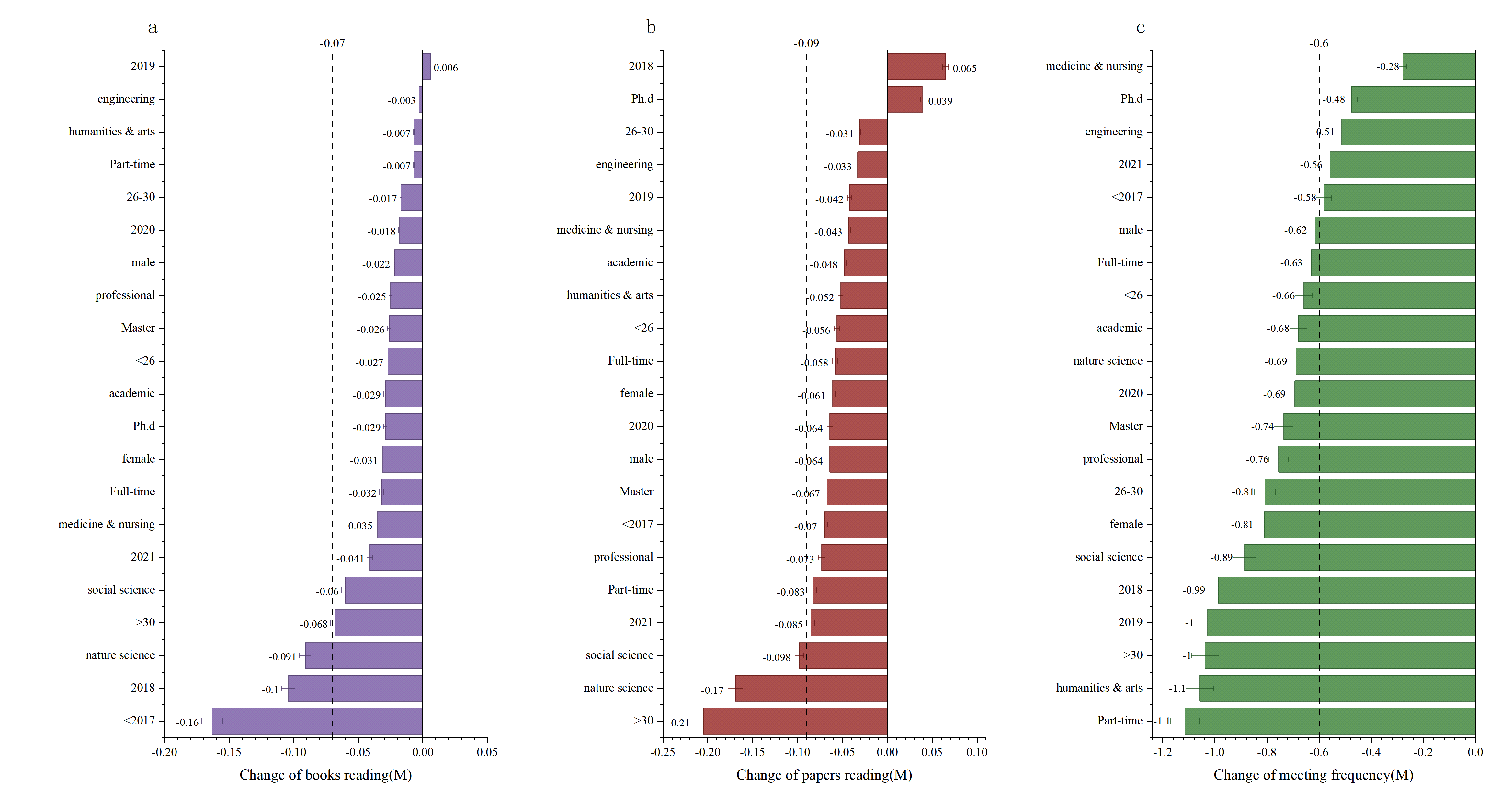
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable Sample 1-Sample 2 | | TS | SE | | STS | | p | | Adj. *p*a |
| Age | >30-<26 | 132.325 | 37.738 | 3.506 | | 0.000 | | 0.001 | |
|  | >30-26-30 | 144.938 | 41.626 | 3.482 | | 0.000 | | 0.001 | |
|  | <26-26-30 | -12.613 | 24.771 | -0.509 | | 0.611 | | 1.000 | |
| Admission Year | 2018-2019 | -32.181 | 76.303 | -0.422 | | 0.673 | | 1.000 | |
| 2018-before 2017 | 90.954 | 118.674 | 0.766 | | 0.443 | | 1.000 | |
| 2018-2020 | -185.383 | 74.250 | -2.497 | | 0.013 | | 0.125 | |
| 2018-2021 | -253.760 | 74.209 | -3.420 | | 0.001 | | 0.006 | |
| 2019-before 2017 | 58.773 | 99.058 | 0.593 | | 0.553 | | 1.000 | |
| 2019-2020 | -153.202 | 35.244 | -4.347 | | 0.000 | | 0.000 | |
| 2019-2021 | -221.579 | 35.157 | -6.303 | | 0.000 | | 0.000 | |
| before 2017-2020 | -94.429 | 97.485 | -0.969 | | 0.333 | | 1.000 | |
| before 2017-2021 | -162.806 | 97.454 | -1.671 | | 0.095 | | 0.948 | |
| 2020-2021 | -68.377 | 30.445 | -2.246 | | 0.025 | | 0.247 | |
| Discipline | J1-J2 | -306.421 | 77.560 | -3.951 | | 0.000 | | 0.001 | |
|  | J1-J3 | -340.062 | 37.105 | -9.165 | | 0.000 | | 0.000 | |
|  | J1-J4 | -443.626 | 65.940 | -6.728 | | 0.000 | | 0.000 | |
|  | J5-J2 | -248.823 | 74.588 | -3.336 | | 0.001 | | 0.009 | |
|  | J5-J3 | -282.463 | 30.405 | -9.290 | | 0.000 | | 0.000 | |
|  | J5-J4 | -386.027 | 62.416 | -6.185 | | 0.000 | | 0.000 | |
|  | J2-J3 | -33.641 | 73.853 | -0.456 | | 0.649 | | 1.000 | |
|  | J2-J4 | -137.205 | 91.791 | -1.495 | | 0.135 | | 1.000 | |
|  | J3-J4 | -103.564 | 61.537 | -1.683 | | 0.092 | | 0.924 | |

Note: 1. Each row tested the null hypothesis that "the distribution of Sample 1 is not significantly different from that of Sample 2". The results displayed asymptotic significance (two-tailed test) with a significance level of .05.The adjusted significance level was calculated using Bonferroni correction to account for multiple testing.

2. J1: Humanities & Arts; J2: Nature science; J3: Engineering; J4: Medicine & nursing; J5: Social science.

*3.2.3 Effects of COVID-19 on Graduate Students’ Reading Habits and Academic Supervision Across Various Factors*

The three graphs of **Figure 2** labelled as a, b, and c show the mean difference in each group before and after intervention for different factors. The groups are sorted based on their mean differences from largest to smallest.



**Figure 2** Comparison of changes in book reading, paper reading and supervisor monitoring before vs after pandemic outbreak among graduate students across different factors

For Figure 2a, the mean value is=, where n = 2298 represents the sample size, denotes the value of the i-th sample in Figure a (grouped by book reading amount) is indicated, with an associated error margin of 5%. Similarly, Figures b and c are also replicated in this example.

Overall, the data presented in Figure 2 suggest that the COVID-19 pandemic has had a significant impact on graduate students’ reading habits and frequency of communication with their supervisors. In terms of book reading (Figure 2a), all groups showed varying degrees of decrease except for those who enrolled in 2019, whose mean reading amount increased slightly after the outbreak. The most significant decreases were observed among natural science majors and participants who enrolled before 2019.

In Figure 2b, there was a slight increase in literature reading among some subgroups but natural science majors and individuals over 30 years old experienced more significant declines compared to other groups. These findings highlight how different factors such as major category or age may influence changes in graduate students' reading habits during pandemics.

Furthermore, Figure 2c shows that there were overall decreases across all subgroups regarding communication frequency between graduate students and their supervisors with some experiencing larger declines than others. This suggests that remote supervision during pandemics may have negatively impacted mentorship dynamics inside universities.

In conclusion, these results emphasize the importance of considering various personal and academic characteristics when investigating changes in graduate student learning experiences during disruptive events like pandemics while providing insights into how different factors can impact academic performance or mentoring interactions within university settings.

*3.2.4 Correlation analysis*

According to Table 5, the correlation analysis (Kendall's tau-b), there is no significant correlation between changes in book reading quantity and supervisor communication change (correlation coefficient = -0.027, p > .05). However, it can be seen that there is a significant positive correlation between changes in book reading and paper reading (r = 0.231, p < .01). And there is a significant negative correlation between changes in paper reading quantity and supervisor communication change (correlation coefficient = -0.053, p < .01). This suggests that students may reduce their frequency of communication with supervisors when they increase their paper readings.

**Table 5** Correlation analysis among changes in book reading, changes in paper reading, and changes in supervisor communication among graduate students in China (Kendalls tau-b)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable |  | 1 | 2 | 3 |
| 1.Changes in book reading | Correlation Coefficient | 1 |  |  |
| p-value (two-tailed) | . |  |  |
| N | 2298 |  |  |
| 2.Changes in paper reading | Correlation Coefficient | .231\*\* | 1 |  |
| p-value (two-tailed) | .000 | . |  |
| N | 2298 | 2298 |  |
| 3.Changes in supervisor communication | Correlation Coefficient | -.027 | -.053\*\* | 1 |
| p-value (two-tailed) | .129 | .003 | . |
| N | 2298 | 2298 | 2298 |

Notes: \*\* indicates at the 0.01 level (two-tailed), the correlation is significant.

**4. Discussion**

The outbreak of COVID-19 has caused significant disruptions to the education system, including postgraduate students’ academic activities. This study investigated the impact of COVID-19 on postgraduate students in terms of their reading habits and communication with their supervisors. Based on our results, we responded to the three research questions as follows: Based on our results, we responded to the three research questions as follows:

RQ1: The overall profile of postgraduate students showed a decrease in book reading, article reading, and communication with their supervisors after the outbreak compared to before. However, there were slight increases observed for some subgroups such as doctoral students or those who enrolled in 2019.

It has been discovered in our study that pandemics can greatly affect reading habits and communication between postgraduate students and their supervisors. Our current findings align with previous studies which have also found that the pandemic has created various difficulties, including restricted access to resources like libraries and reduced opportunities for face-to-face interactions with instructors. Such challenges have been documented in studies conducted by Sucena et al. (2022) and Wang (2022). The shift towards remote learning and social distancing measures have led to reduced access to physical resources like libraries reducing opportunities for traditional book or paper readings (Betthäuser et al., 2023; Bashir et al., 2021). Several factors could contribute to this phenomenon such as reduced academic pressure leading to psychological stress reduction resulting in lower demands for literature readings (Barbayannis et al.; Yang &Yang 2022); difficulty transitioning from physical books to digital formats (Pressley, 2021); negative psychological impacts like anxiety or depression affecting self-motivation even when using electronic devices for reading purposes (Badahdah et al., 2020); physiological effects like visual fatigue caused by long periods staring at screens while digitally consuming content.

However, based on our study, our findings differ slightly from the results of the 19th National Reading Survey in China, which reported that the number of paper books read per adult national in China increased from 4.70 in 2020 to 4.76 in 2021, while the number of e-books reads per capita also increased slightly from 3.29 in 2020 to 3.30 in 2021(National Library Institute of China, 2022). Our study has identified specific challenges faced by postgraduate students during the pandemic that may have affected their reading habits and communication with supervisors.

In conclusion, online learning offers new opportunities during current pandemic restrictions but comes with challenges negatively affecting graduate student’s book and paper readings requiring solutions such as providing more extensive e-resources access options reducing workload pressures where possible fees waivers if any so that graduate students can cope better under uncertain times.

RQ2: Few significant differences were found between individual student characteristics and changes in reading and reading papers during the pandemic, but significant differences were found between individual student characteristics and changes in supervisor communication.

Our study found older participants who are more than 30-years reported fewer changes in paper readings than younger ones. It suggests that older participants, specifically those over 30 years old, are less likely to change their paper readings compared to younger individuals. This could have important implications in terms of understanding the reading behavior and preferences of different age groups. Similarly, previous studies provide insights into how age can affect various aspects of reading behavior and cognition such as changes in paper readings or differences in online vs offline reading abilities among different age groups (Hannon & Daneman, 2009; Jiang et al., 2021).

However, our analysis identified significant differences in the changes of supervisor monitoring among graduate students based on various factors such as individual characteristics (gender, age) and learning characteristics (level, form of study). This contradicts that of Azure (2016), who reported there were no significant differences between supervisor supervision attributes based on course, instructor, course structure, gender, and semester.

Firstly, there was a statistically significant difference in mentor supervision based on gender, with female students receiving less supervision than male students. These findings are similar to previous studies on the gender impact of the pandemic, which have focused on the unequal impact experienced by female researchers and graduate students (Myers et al., 2020; Staniscuaski et al., 2021). Secondly, the age group had a significant impact on changes in mentor supervision, with older graduate students reporting lower levels of supervision compared to younger ones. Moreover, the research found that PhD candidates reported fewer impacts on supervisor monitoring as compared to Master’s degree candidates. The type of study program also played an important role in changes in supervisor monitoring behaviors. Regarding admission year, there were notable differences between graduate students admitted before and after the outbreak occurred (2018 vs 2021; 2019 vs 2020; and 2019 vs 2021). Finally, among disciplinary variables, significant differences were observed between humanities and natural sciences/engineering/medicine as well as social sciences and natural sciences/engineering/medicine regarding changes in mentoring. Similar findings have been found in previous related studies examining the impact of pandemics on research activities across disciplines (Conley & Johnson, 2021; Sohrabi et al., 2021).

These findings suggest that certain factors can impact mentorship communication during disruptive events like pandemics. It is important to consider these factors when interpreting study outcomes across different subgroups within major categories.

In conclusion, these findings suggest that while the pandemic may have affected all students’ reading habits and paper reading to some extent, the impact on communication with supervisors may have been more influenced by individual factors. These individual factors could include factors such as the student’s personality, learning style, and prior relationship with their supervisor. Understanding these individual differences can help us to provide targeted support and guidance to students during challenging times like the pandemic.

RQ3: There was a positive correlation between changes in book reading amount and paper reading amount during the pandemic period suggesting that those who increased one type of academic material most likely did so for both types together. However, However, a negative correlation was found between changes in paper reading and mentoring by supervisors.

Specifically, the positive correlation between changes in book reading and essay reading during the pandemic suggests that people who increase their reading of one type of academic material are also more likely to read the other. This may be because the fact that the two types of materials are interrelated and complement each other, e.g., books provide background information on a topic, while dissertations provide in-depth analysis.

On the other hand, the negative correlation found between changes in paper reading and mentoring suggests that increased paper reading during the pandemic may have resulted in less communication or mentoring from mentors. This may be due to the fact that those who read more papers may be more independent in their research and need less guidance from their mentors. Alternatively, pandemic-induced challenges, such as reduced face-to-face communication, may also make it difficult for mentors to provide guidance and direction to students. Reduced academic pressure and difficulty transitioning to digital formats may affect communication effectiveness between mentors and mentees negatively. Negative emotions such as anxiety or depression can lead to avoiding communication with their mentors due to fear of appearing incompetent or vulnerable. Visual fatigue can cause decreased motivation for extended periods of reading or interacting online.

**5. Conclusion**

In conclusion, this study emphasizes the importance of considering different major categories separately when interpreting study outcomes. It provides insights into how pandemics affect postgraduate students' reading habits and communication with their mentors while identifying several factors that influence these behaviors. Therefore, universities must adapt flexible support measures in response to changing academic environments caused by crises like COVID-19 and investigate further ways of improving mentoring relationships between supervisors and students under such conditions.

In addition to the conclusions presented in the above paper, there are several implications and potential areas of discussion that could be explored further. One implication is that institutions need to consider providing more comprehensive support measures to help students cope with the changing academic environment in a crisis such as COVID-19. This may include providing additional electronic resources or minimizing workload pressures. In addition, institutions may need to provide training or guidance to graduate students on how to effectively transition from physical books to digital formats.

Another point of discussion is the impact of reduced communication between graduate students and their mentors/professors due to distance constraints or Internet connectivity issues. While virtual learning environment tools hold great promise for improving access to and the quality of mentoring/supervised experiences, even after the pandemic period, institutions must ensure that adequate support structures, such as regular check-ins and opportunities for feedback sessions, are in place. In addition, this study highlights how individual student characteristics, such as gender, age, year of enrollment, and disciplinary group, influence changes in book reading, article reading, and instructor communication during a pandemic. These factors suggest the need for a targeted approach when designing support systems during a disruptive event such as a pandemic. Finally, collaboration between different disciplines can lead to a better understanding of these phenomena, and exploring other sources, such as books, reports, and conference proceedings, can complement research findings.

Overall, this paper provides insights into how pandemics affect graduate students' reading habits, mentor supervision, and some potential factors influencing graduate student behavior that need to be further investigated through future research, highlighting the importance of considering different broad categories separately when interpreting research findings so that universities can adopt solutions accordingly. We also highlight areas requiring further investigation through future research studies to improve mentoring relationships between supervisors and students under such conditions.

**References**

Abiddin, N. Z., Ismail, A., & Ismail, A. (2011). Effective supervisory approach in enhancing postgraduate research studies. *Journal of Educational and Social Research,* 1(1), 47-54.

Alam, F., Alam, Q., & Rasul, M. (2013). A Pilot Study on Postgraduate Supervision. *Procedia Engineering*, 56, 875-881.

Ali, P.A., Watson, R., & Dhingra, K. (2016). Postgraduate Research Students’ and their Supervisors’ Attitudes towards Supervision. *International Journal of Doctoral Studies,* 11, 227-241.

Al-Jarf, R. (2021). Collaborative mobile ebook reading for struggling EFL college readers. IOSR J. Res. *Method Educ*. 11, 32–42.

Alnahdi, A. S., and Aftab, M. (2020). Academic stress, study habits and academic achievement among university students in Jeddah. Int. J. *Psychosoc. Rehabil*. 24, 97–104. doi: 10.37200/IJPR/V24SP1/PR201138

Andrade, D., Ribeiro, I. J., & Máté, O. (2023). Academic burnout among master and doctoral students during the COVID-19 pandemic. *Scientific Reports*, 13(1), 1-7. <https://doi.org/10.1038/s41598-023-31852-w>

Annamalai, S., & Muniandy. B. (2013). Reading habit and attitude among Malaysian polytechnic students. *International Online Journal of Educational Sciences*, 5(1), 32-41.

Azure, J.A. (2016). Students’ Perspective of Effective Supervision of Graduate Programmes in Ghana. *American Journal of Educational Research,* 4, 163-169.

Baba, J., & Rostam Affendi, F. (2020). Reading Habit and Students’ Attitudes Towards Reading: A Study of Students in the Faculty of Education UiTM Puncak Alam. *Asian Journal Of University Education,* 16(1), 109-122. doi:10.24191/ajue.v16i1.8988

Badahdah, A. M., Khamis, F., & Mahyijari, N. A. (2020). The psychological well-being of physicians during COVID-19 outbreak in Oman. *Psychiatry research*, 289, 113053. https://doi.org/10.1016/j.psychres.2020.113053

Barbayannis, G., Bandari, M., Zheng, X., Baquerizo, H., Pecor, K. W., & Ming, X. (2022). Academic Stress and Mental Well-Being in College Students: Correlations, Affected Groups, and COVID-19. *Frontiers in psychology,* 13, 886344. <https://doi.org/10.3389/fpsyg.2022.886344>

Bashir, A., Bashir, S., Rana, K., Lambert, P., & Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. *Frontiers in Education*, 6. https://doi.org/10.3389/feduc.2021.711619

Betthäuser, B.A., Bach-Mortensen, A.M., & Engzell, P. (2023). A systematic review and meta-analysis of the evidence on learning during the COVID-19 pandemic. *Nature Human Behaviour,* 7, 375-385.

Chettri, K. (2013). Reading Habits - An Overview. IOSR Journal of Humanities and Social Science, 14, 13-17.

Conley, D., & Johnson, T. (2021). Past is future for the era of COVID-19 research in the social sciences. *Proceedings of the National Academy of Sciences*, 118(13), e2104155118. https://doi.org/10.1073/pnas.2104155118

Dadzie, P. S. (2009). Reading for education: The roles of libraries. *Ghana Libr.* J. 20, 1–14. doi: 10.4314/glj.v20i1.33978

Ehsan, T., and Sultana, N. (2020). Predicting the role of study habits in academic achievement: A study of university students in Punjab.*Pak. J. Educ.* 37, 95–112. doi: 10.30971/pje.v37i1.1410

Fabriz, S., Mendzheritskaya, J., & Stehle, S. (2021). Impact of Synchronous and Asynchronous Settings of Online Teaching and Learning in Higher Education on Students' Learning Experience During COVID-19. *Frontiers in psychology,* 12, 733554. https://doi.org/10.3389/fpsyg.2021.733554

Fatiloro, O. F., Oyekola, A. A., & Hameed, B. A. (2017). A survey on the reading habits among colleges of education students in the information age. *Journal of Education and Practice,* 8(8), 106-110. ISSN 2222-288X (Online).

Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & Tadeu, P. (2022). Online education in higher education: emerging solutions in crisis times. *Heliyon,*8(8), e10139. <https://doi.org/10.1016/j.heliyon.2022.e10139>

García-Morales, V. J., Garrido-Moreno, A., & Martín-Rojas, R. (2021). The Transformation of Higher Education After the COVID Disruption: Emerging Challenges in an Online Learning Scenario. *Frontiers in psychology*, 12, 616059. <https://doi.org/10.3389/fpsyg.2021.616059>

González-Ocampo, G., & Castelló, M. (2018). How do doctoral students experience supervision? *Studies in Continuing Education,* 41, 293 - 307.

Hannon, B., & Daneman, M. (2009). Age-related changes in reading comprehension: an individual-differences perspective. *Experimental aging research,* 35(4), 432–456. https://doi.org/10.1080/03610730903175808

Hashiguchi, A., Hamada, H., Takahashi, S., & Honda, K. (2022). Impact of supervisors' research style on young biomedical scientists' capacity development as measured by REDi, a novel index of crossdisciplinarity. *Frontiers in Research Metrics and Analytics*, 7, 990921. https://doi.org/10.3389/frma.2022.990921

Hassan, I., Latiff Azmi, M. N., Muhamad, S. N., and Abdullah, A. T. H. (2021). Reading habits and their correlation with reading achievement among ESL learners in selected Malaysian secondary schools.*Arab World En*g. J. (AWEJ) 12, 385–399. doi: 10.24093/awej/vol12no3.27

Horbec, D. (2012). The link between reading and academic success. *English in Australia,* 47(2), 58-6.

Ismail, A., Abiddin, N.Z., & Hassan, A. (2011). Improving the Development of Postgraduates' Research and Supervision. *International Education Studies, 4*, 78-89.

Jiang, Y., Chen, Y., Lu, J., & Wang, Y. (2021). The Effect of the Online and Offline Blended Teaching Mode on English as a Foreign Language Learners’ Listening Performance in a Chinese Context. *Frontiers in Psychology,* 12, 742742. <https://doi.org/10.3389/fpsyg.2021.742742>

Kidd, D. C., & Castano, E. (2013). Reading literary fiction improves theory of mind. *Science*, 342, 377–380. doi:10.1126/science .1239918

Kram, K. E., & Isabella, L. A. (1985). Mentoring alternatives: The role of peer relationships in career development. *Academy of Management Journal,* 28(1), 110–132. doi:10.2307/256064.

Krumsvik, R.J., Skaar, Ø.O., Røkenes, F.M., Solstad, S.H., & Høydal, K.L. (2022). Experiences of WNGER II Ph.D. Fellows During the COVID-19 Pandemic – A Case Study. *Frontiers in Education.*

Lechuga, V.M. (2011). Faculty-graduate student mentoring relationships: mentors’ perceived roles and responsibilities. *Higher Education, 62*, 757-771.

Lim, P.C., Sidhu, G.K., Chan, Y.F., Lee, L.F., Jamian, L.S. (2016). Assessing Writing Skills of Postgraduate Students: Perspectives of Supervisors and Supervisees. In: Tang, S., Logonnathan, L. (eds) *Assessment for Learning Within and Beyond the Classroom.* Springer, Singapore. <https://doi.org/10.1007/978-981-10-0908-2_3>

Lockee, B.B. (2021). Online education in the post-COVID era. *Nature Electronics,* 4, 5 - 6. https://doi.org/10.1038/s41928-020-00534-0

Lokhtina, I.A., Castelló, M., Lambrechts, A.A., Löfström, E., McGinn, M.K., Skakni, I., & van der Weijden, I. (2022). The impact of the COVID-19 pandemic on early career researcher activity, development, career, and well-being: the state of the art. *Studies in Graduate and Postdoctoral Education.*

Marinoni, G., Van't Land, H., and Jensen, T. (2020). The Impact of Covid-19 on Higher Education Around the World. *IAU Global Survey Report.* Available online at: <https://www.iau-aiu.net/IMG/pdf/iau_covid19_and_he_survey_report_final_may_2020.pdf> (accessed June 7, 2023).

Méndez M (2018) Ten simple rules for developing good reading habits during graduate school and beyond. *PLOS Computational Biology* 14(10): e1006467.<https://doi.org/10.1371/journal.pcbi.1006467>

Miller L. (2020). Remote Supervision in Primary Care during the Covid-19 pandemic - the "new normal"?. *Education for primary care : an official publication of the Association of Course Organisers, National Association of GP Tutors, World Organisation of Family Doctors,* 31(6), 332–336. <https://doi.org/10.1080/14739879.2020.1802353>

Ministry of Education of the People’s Republic of China. (2023). 2022 National Enrollment of Graduate Students. Available online at <http://www.moe.gov.cn/fbh/live/2023/55167/mtbd/202303/t20230324_1052504.html> (accessed June 6, 2023).

Mohd Noor, N. (2011). Reading Habits and Preferences of EFL Post Graduates: A Case Study, *Indonesian Journal of Applied Linguistics*, Vol. I No.1. on April 3, 2018 from: http://balaibahasa.upi.edu

Myers, K. R., Tham, W. Y., Yin, Y., Cohodes, N., Thursby, J. G., Thursby, M. C., ... & Walsh, J. T. (2020). Unequal effects of the COVID-19 pandemic on scientists. *Nature Human Behaviour*, 4(9), 880-883. doi:10.1038/s41562-020-0921-y

National Library Institute of China. (2022) Results of the 19th national reading survey released. National Library Journal, 31(03):38 [第十九次全国国民阅读调查结果发布[J].国家图书馆学刊,2022,31(03):38.].

Okeke-Uzodike, O. E. (2021). Postgraduate supervision in a South African transforming academic environment: A reflexivity approach. *Issues in Educational Research*, 31(4), 1175-1194. http://www.iier.org.au/iier31/okeke-uzodike.pdf

Park, E.H., Ha, G., Lee, S., Lee, Y.Y., & Lee, S.M. (2019). Relationship Between the Supervisory Working Alliance and Outcomes: A Meta‐Analysis. *Journal of Counseling & Development.*

Plakhotnik, M. S., Volkova, N. V., Jiang, C., Yahiaoui, D., Pheiffer, G., McKay, K., & Newman, S. (2021). The Perceived Impact of COVID-19 on Student Well-Being and the Mediating Role of the University Support: Evidence From France, Germany, Russia, and the UK. *Frontiers in Psychology,* 12. <https://doi.org/10.3389/fpsyg.2021.642689>

Pozo, J., Pérez Echeverría, M., Cabellos, B., & Sánchez, D. L. (2021). Teaching and Learning in Times of COVID-19: Uses of Digital Technologies During School Lockdowns.*Frontiers in Psychology,*12. <https://doi.org/10.3389/fpsyg.2021.656776>

Pressley, T. (2021). Factors Contributing to Teacher Burnout During COVID-19. *Educational Researcher*, 50, 325 - 327.

Rensburg, G.H., Mayers, P.M., & Roets, L. (2016). Supervision of post-graduate students in higher education.

 Rosli, N.A., Razali, N.F., Zamil, Z.U., Noor, S.N., & Baharuddin, M.F. (2018). The Determination of Reading Habits among Students: A Concept. T*he International Journal of Academic Research in Business and Social Sciences*, 7, 791-798. doi: 10.6007/IJARBSS/v7-i12/3710

Saleem, T., & Mehmood, N. (2018). Assessing the quality of supervision experiences in the different research stages at postgraduate level. *Journal of Education and Educational Development*, 5(2), 8–27. <https://doi.org/10.22555/joeed.v5i2.1851>

Sangkaeo, S. (1999). Reading Habit Promotion in ASEAN Libraries.

Sellers, T. P., Alai-Rosales, S., & MacDonald, R. P. (2016). Taking Full Responsibility: the Ethics of Supervision in Behavior Analytic Practice. *Behavior analysis in practice*, 9(4), 299–308. <https://doi.org/10.1007/s40617-016-0144-x>

Shen, W., & Jiang, J. (2021). Institutional prestige, academic supervision and research productivity of international PhD students: Evidence from Chinese returnees. *Journal of Sociology.* <https://doi.org/10.1177/14407833211055225>

Shen, Y., & Hu, G. (2021). Chinese graduate students' perceptions of plagiarism: A mixed-methods study. Accountability in research, 28(4), 197–225. <https://doi.org/10.1080/08989621.2020.1819253>

Sidhu, G.K., Kaur, S., Fook, C.Y., & Yunus, F.W. (2013). Postgraduate Supervision: Exploring Malaysian Students’ Experiences. *Procedia - Social and Behavioral Sciences*, 90, 133-141.

Şimşek, A.B. (2021). A decision support tool for the student-supervisor allocation problem of postgraduate programs. *Expert Syst. Appl.*, 190, 116068.

Singh, Y. G. (2011). Academic achievement and study habits of higher secondary students. *International Referred Research Journal*, 3(27): 2

Sohrabi, C., Mathew, G., Franchi, T., Kerwan, A., Griffin, M., Soleil C Del Mundo, J., Ali, S. A., Agha, M., & Agha, R. (2021). Impact of the coronavirus (COVID-19) pandemic on scientific research and implications for clinical academic training - A review. *International journal of surgery (London, England)*, 86, 57–63. <https://doi.org/10.1016/j.ijsu.2020.12.008>

Spronken-Smith, R., Brown, K., Cameron, C., McAuliffe, M.J., Riley, T., & Weaver, C.K. (2022). COVID-19 impacts on early career trajectories and mobility of doctoral graduates in Aotearoa New Zealand. *Higher Education Research & Development*.

Staniscuaski, F., Kmetzsch, L., Soletti, R. C., Reichert, F., Zandonà, E., Ludwig, Z. M. C., Lima, E. F., Neumann, A., Schwartz, I. V. D., Mello-Carpes, P. B., Tamajusuku, A. S. K., Werneck, F. P., Ricachenevsky, F. K., Infanger, C., Seixas, A., Staats, C. C., & de Oliveira, L. (2021). Gender, Race and Parenthood Impact Academic Productivity During the COVID-19 Pandemic: From Survey to Action. *Frontiers in psychology,* 12, 663252. https://doi.org/10.3389/fpsyg.2021.663252

Sucena, A., Silva, A. F., & Marques, C. (2022). Reading skills intervention during the Covid-19 pandemic. *Humanities and Social Sciences Communications*, 9(1), 1-6. <https://doi.org/10.1057/s41599-022-01059-x>

Tang E. (2022). Public objectives and policy instruments for improving the quality of postgraduate education in China. *Frontiers in psychology,* 13, 968773. <https://doi.org/10.3389/fpsyg.2022.968773>

UNESCO. (2022). Report reveals the state of higher education two years on from the disruption of Covid-19, Available online at: <https://www.iesalc.unesco.org/en/2022/05/18/report-reveals-the-state-of-higher-education-two-years-on-from-the-disruption-of-covid-19/> (accessed June 7, 2023).

Wang, J., Liang, Z., Zhang, M., Kang, D., & Zeng, Q. (2022). Effects of the COVID-19 Pandemic on Chinese Graduate Students’ Learning Activities: A Latent Class Analysis. *Frontiers in Psychology*, 13. https://doi.org/10.3389/fpsyg.2022.877106

Whitten, C., Labby, S., & Sullivan, S. (2016). The impact of pleasure reading on academic success. *Journal of Multidisciplinary Graduate Research,* 2(4) 48-4.

Wisker, G., McGinn, M.K., Bengtsen, S.S., Lokhtina, I., He, F., Cornér, S., Leshem, S., Inouye, K., & Löfström, E. (2021). Remote doctoral supervision experiences: Challenges and affordances. *Innovations in Education and Teaching International*, 58, 612 - 623.

Yang, Y., & Yang, P. (2022). Effect of College Students' Academic Stress on Anxiety Under the Background of the Normalization of COVID-19 Pandemic: The Mediating and Moderating Effects of Psychological Capital. *Frontiers in psychology*, 13, 880179. https://doi.org/10.3389/fpsyg.2022.880179

Zapata-Garibay, R., González-Fagoaga, J.E., González-Fagoaga, C.J., Cauich-García, J.R., & Plascencia-López, I. (2021). Higher Education Teaching Practices Experience in Mexico, During the Emergency Remote Teaching Implementation due to COVID-19. *Frontiers in Education*.