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## Reading Format Attitudes in the Time of COVID

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### ABSTRACT

The objective of this paper is to investigate the impact of the COVID-19-related changes to educational delivery on students' academic reading format preferences and behaviors. Pre-pandemic studies showed that students preferred print when needing to engage in academic texts for their coursework, and that under certain circumstances, students learned better when using print texts. During the pandemic however, many institutions implemented a sudden shift to remote learning and electronic readings. We questioned whether students would adjust their learning strategies to accommodate the abrupt change, and whether the increased experience with e-formats would boost their favorable attitudes towards digital reading. This study's data from students at a North American university does not support this hypothesis. While some respondents did report improved attitudes towards e-reading during COVID, most attitudes were less favorable or reflected no change. Nearly half the respondents stated that they highlighted and annotated their readings less than they did before, and over a third said they completed their assigned readings less frequently. Negative feelings may reflect a new trend in attitudes or they may be a temporary outcome of general screen fatigue. The findings reinforce the importance of providing print format options for students during this time.

### Introduction

Studies investigating tertiary students' attitudes and behaviors with print and electronic reading formats over the last twenty years show a consistent preference for print reading when deep learning is required, (e.g. Dilevko & Gottlieb, 2002; Liu, 2006; Mizrachi, Salaz, Kurbanoglu, & Boustany, 2021; Mizrachi, Salaz, Kurbanoglu, Boustany, & ARFIS Research Group, 2018). Beginning in March 2020 however, the COVID-19 pandemic and its ensuing restrictions forced many universities to transition suddenly from in-person to remote learning. Academic libraries closed their physical facilities, curtailed in-house services, and circumstances often forced students to rely exclusively on electronic texts for their course work. We investigated how these fundamental changes in the learning environment affected students' engagement with and attitudes towards reading academic texts (textbooks, books, book chapters, journal articles, etc.) in different formats. Suddenly students had no reading format choice and we wondered whether this affected their attitudes and behaviors. Behavioral changes could include shifts in levels of engagement with reading assignments, such as highlighting or annotating texts. We wondered how student attitudes towards print and electronic formats might compare to studies performed before COVID.

The shock of an external event of this magnitude created conditions to generate further insights into how the increased use of e-texts might affect attitudes and perceptions of e-reading among tertiary learners.

This paper presents results from a survey of 234 University of California Los Angeles (UCLA) students' attitudes towards reading academic texts in print and online during the COVID-19 pandemic. It is part of a larger comparative study with students at universities in the United Kingdom. During the restrictions, a number of researchers surveyed students' attitudes and ease of adapting to remote learning but few investigated their e-reading attitudes or remote library use. We conducted this study to fill in those gaps and create a broader picture of our students' academic lives during COVID by addressing these research questions:

- What is the impact of forced remote learning on students' academic reading format attitudes and preferences?
- Do students report changes in their reading and learning engagement strategies?
- Are there variations in response among students of different demographics and circumstances?

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- How do surveyed students' collective reading format preferences and behaviors compare to those documented before COVID?

We defined academic texts as textbooks, scholarly books, book chapters, and journal articles in different formats used for coursework or academic projects. Print format included texts originating on paper and printouts from an electronic source. Electronic reading was reading on any digital device. We did not include audio texts.

## Literature review

### *Print and electronic reading studies performed before COVID-19*

Researchers have been interested in students' behaviors and attitudes towards digital reading ever since electronic formats became viable for academic use. Pundits of the book trade assumed that e-books would overtake print because of their convenience and general affordability. After the initial excitement however, sales of e-books appear to have flattened, with the latest statistics showing that print continued to outsell e-books in the U.S. Even during the pandemic, "Print books continued to dominate the market during the year," (Anderson, 2021). To the surprise of many in various areas of education, studies continued to show that tertiary students preferred to read their academic texts in print for deep learning tasks such as when they needed to focus and internalize the information (Dilevko & Gottlieb, 2002; Liu, 2006; Mizrachi, 2015; Mizrachi & Salaz, 2020). One of the largest studies to date documenting this phenomenon is the Academic Reading Format International Study (ARFIS) (Mizrachi et al., 2021).

Our examination attempts to build upon findings from ARFIS by borrowing questions and themes from their instrument to enable comparisons of attitudes and behaviors before the pandemic to those during the sudden shift to remote learning.

Forty-two researchers in 33 countries collaborated on ARFIS, using the same instrument to survey over 21,000 students (Muthuprasad et al., 2021; Mizrachi et al., 2021). Data gathering occurred from 2014 to 2017 and was analyzed in three stages. Quantitative results from 10,293 responses in 21 countries showed that over 78% of the students stated a preference for reading academic course materials in print (Mizrachi et al., 2018). Majorities in each country preferred print. Majorities in all countries also agreed or strongly agreed that they could focus better and remember the information better when they read in print. Final quantitative analysis of all 21,265 students in 33 countries (Mizrachi et al., 2021) confirmed earlier findings. ARFIS researchers then performed a qualitative analysis of English language comments by students categorized as either print preferers or electronic preferers to discover the reasons for their preferences, and under what circumstances they would consider reading a text in their less preferred format (Mizrachi & Salaz, 2020). Results showed that while students may have had a preferred format, their behaviors were flexible and depended on circumstances surrounding the reading task such as its importance to their coursework, the length of the reading and convenience of access. In general, students believed they could engage (highlight, annotate) and learn better with print, but they liked the convenience of electronic formats, the features that allow them to find specific information within a text, and the perceived environmental and cost benefits. Salaz and Mizrachi (2021) captured the reading circumstances that seemed to coincide with stronger print or digital preference among tertiary learners in the reading event analysis model (REAM).

These self-reported reader preference studies at the tertiary level sit alongside a body of literature suggesting that empirically, under certain circumstances, students do not learn or remember information as well when reading from electronic text. We believe that users' preferences regarding format, and self-reported expressions of perceived limits on learning, memory, and focus when using electronic text under certain conditions, can be relied upon to reflect an accurate sense of their own learning impacts. In her book *How We Read Now*, Naomi Baron (2021)

summarizes a body of individual experimental studies and meta-analyses examining the effects of print versus digital reading across both K12 and tertiary contexts, concluding that "[c]omprehension was better when reading in print than reading onscreen." (p. 79). Most recently, Salmerón, Vargas, Delgado, et al. (2022) analyze data from nearly 300,000 4th and 8th grade students as the basis for their report that the daily use of digital devices in language arts classrooms is negatively associated with reading comprehension scores.

Examining differences in the structure and outcomes of preference and experimental studies in this area reveals a number of factors and variables that likely matter, or make a difference, in how important format differences might be for a given reading task of circumstance. In sum, the evidence suggests that for certain types of reading tasks, especially lengthy, more challenging, or high-stakes reading, print reading maintains a learning and memory advantage; but that the cost and convenience affordances of e-formats make them perfectly suitable for other types of reading, or at times, worth some level of learning compromise when compared to print.

The ARFIS study (Mizrachi et al., 2021) also detected a correlation between age and strength of print preference, with larger numbers of younger, first-year university students preferring print. There are several possible explanations for this phenomenon. One is that younger respondents earlier in their academic careers have less experience using e-text, and thus are not as inclined towards it. If true, we would expect that using e-text more frequently would lead to its improved likability among this cohort. Another explanation is that because younger students are less immersed in their academic fields, they may find the scholarly level of college texts more challenging and thus prefer to read and engage with them in print format for improved comprehension. We have seen tertiary students report that they prefer print for more difficult, challenging, and lengthy texts that require deep concentration and focus. Upperclassmen and graduate-level students are usually more familiar with the jargon and methods of their disciplines, and therefore may find the kinds of academic texts they are engaging with to be more accessible and better suited to electronic format. By the time the present study was conducted in March 2021, respondents had acquired a year of experience utilizing academic e-texts, making it a natural opportunity to glean further insight into how this added experience might influence their preferences.

### *Format preference studies during COVID*

A number of studies investigated how students in different areas of the world adapted to the sudden shift to remote learning during the pandemic. Both Srinivasan, Ramos, and Muhammad (2021) and Castro and George (2021) reported that many respondents were dissatisfied with exclusive online learning, citing the perceived negative impact on their social and academic engagement with peers and faculty. The researchers found that majorities were open to hybrid learning models, however. Roy and Covelli (2021) found that the ease of adjustment was dependent on students' pre-pandemic comfort levels and experience using digital learning, but overall, students expressed less interest in online classes. Students in India were more receptive to digital learning during the pandemic, citing its flexibility and convenience (Muthuprasad, Aiswarya, Aditya, & Jha, 2021). They did note that connectivity issues in rural areas made access to online learning more challenging. The issue of internet access was a key concern of Barber's investigation into the inherent inequities of remote learning for students from lower socio-economic groups in the U.S. These students may have less access to optimal technologies and learning spaces making it more difficult for them to take full advantage of online learning (Barber et al., 2021). Students at UCLA responded positively to the sudden change to remote learning in a study conducted by their Center for the Advancement of Teaching (UCLA CAT, 2021). None of the studies above however, asked students about their reading or library experiences, which is the central goal of our research.

We found four studies that investigated the impact of COVID restrictions on tertiary students' academic reading preferences and behaviors. The first took place at a branch campus of the University of Nottingham in China where restrictions were implemented earlier than most other countries (Welsen, Pike, & Walker, 2020). Authors report that 73% of students agreed that they had changed their reading behaviors to become more "e-centric", and that most had continued to use e-texts after returning to on-site learning. The survey was distributed to 23 engineering students, and 16 completed it, all of whom were in the same year of their program. It was thus a small and homogenous population, and while the study provides an interesting picture of some students' behaviors at this institution, it is not possible to draw any generalizations for a broader population.

Researchers at Ryerson University in Canada (Baitz & On, 2020) investigated the effects of the COVID pandemic on textbook format preferences. They found that a slight majority of students (52%) favored using print over e-textbooks because the students felt they learned better. Book length and affordability were factors affecting students' attitudes. The largest group of respondents (38.5%) felt that COVID did not affect their preference for print, though 42% reported that COVID-19 did affect their learning significantly. Findings "suggest that traditional textbooks are still preferred but due to the circumstances of the pandemic, many students are adapting to eBooks and many believe that eBooks will be more popular in the future" (p. 3). The data for this study was gathered from 52 participants in November 2020. Therefore, this study also presents an interesting but limited picture of the impact of COVID restrictions on students' format attitudes and behaviors.

A study of 318 students from eight universities in Indonesia also investigated the reading format preferences and behaviors of undergraduates during the COVID pandemic (Parlindungan et al., 2021). Researchers used an online questionnaire based on Mizrachi (2015) which focused on preferred reading formats and factors contributing to students' format choices. Results showed that even during the pandemic, most students still preferred to read their academic texts in print. Factors that contributed to preference included types of courses, accessibility, and established print reading habits.

Librarians at Cambridge University in the United Kingdom surveyed their students in mid-2021 to investigate students' attitudes during COVID (Gleeson et al., 2021). They received 751 responses of which 517 were from undergraduates. Results showed that during non-pandemic circumstances large majorities preferred print for recreational reading, for textbooks, and when needing to read a whole, or most, of a book. E-books were preferred by the majority for studying single chapters, consistent with prior data and hypotheses identifying text length as a factor in determining format effects (Salaz & Mizrachi, 2021). When asked about their anticipated e-book usage in the post-pandemic era, more students replied that their usage will decrease (24%,  $n = 146$ ) than increase (16%,  $n = 101$ ). Sixty percent said it will stay the same. Comments echoed earlier studies citing the convenience of e-books and some e-format features, but some noted the challenges of increased screen time in general. "Because of the pandemic, where so much of life is online, my preference is currently always for print books, to avoid eye-strain;" and "Especially this year when the time I spend on my laptop has increased so drastically, I try to read print books whenever possible," (p. 35). UCLA students in the U.S. also expressed these observations, and the general take-aways from the two studies are remarkably similar.

The current study explores the impact of COVID-19 restrictions on the academic reading behaviors and format preferences among 234 students at a major research university, part of a larger comparative study with tertiary students in the United Kingdom. It investigates many of the same questions as the studies above, but considers additional aspects and conditions endured by a different student population for a broader understanding of this unprecedented phenomenon.

## Methodology and population

The instrument contains some original questions created for this study, and questions 7–14 were adapted from the previously validated ARFIS survey (Mizrachi et al., 2018). The authors developed it in collaboration with Jane Secker and Naomi Baron, who were investigating this topic among other student populations. Students in a graduate and undergraduate class piloted the instrument, after which it was refined and distributed. Eleven questions inquired about students' reading behaviors and attitudes using Likert-style statements, multiple-choice, open, and closed-ended questions. An additional 15 questions sought demographic and contextual information, and an optional open comment space was provided. The Likert-style statements offered a choice of five responses from strongly disagree to strongly agree. Questions that asked students to rate their ability to focus or remember a text when using print and various electronic devices were based on the ARFIS survey. Open questions asking students to list favorite and least favorite features of print and electronic formats were included for comparisons with previous studies as well. Original questions asked students to compare their own behaviors and attitudes regarding e-reading, library use, and reading engagement before COVID to their current experiences. The complete instrument is in Appendix A below. We used SPSS and Excel programs to generate the descriptive analysis.

The study received approval from the UCLA Internal Review Board for Human Subjects, but regulation did not allow us to offer incentives to respondents such as a drawing for gift certificates. The Office of the Registrar emailed the anonymous survey to a randomly generated list of 5000 students (out of a total student population of approximately 39,000) in March 2021. 234 usable responses were received, a 5% response rate. It is possible that the lack of incentives negatively affected participation, or that this study competed with other surveys and university messages demanding attention. We note that a 5% response rate for a survey with no incentives attached is better than expected.

Of the 234 respondents, 56.4% ( $n = 132$ ) were female, 36.8% male ( $n = 86$ ), 4.7% non-binary/prefer not to specify ( $n = 11$ ), and five responses (2.1%) were blank. Most students' were undergraduates (68%,  $n = 160$ ), among whom 29% were in their first year; 23% second year; 31% in their third year; 17% fourth year, and >1% responded as fifth year. 68.8% ( $n = 161$ ) reported their age as between 18 and 25 years. Participants could list multiple responses to the question about their major or field of study to accommodate for double majors and cross-disciplinary studies, therefore for total responses were  $n = 285$ . Fig. 1 illustrates the distribution of majors listed by the respondents.

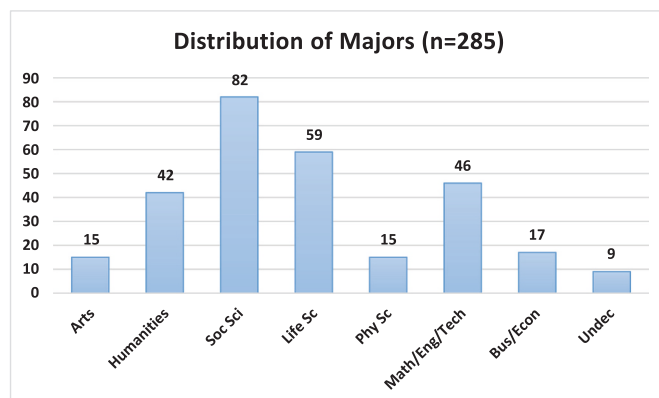


Fig. 1. Distribution of majors.

**Results**

*Attitudes*

In the first category of questions, students reported their feelings about reading online before and during COVID, missing the library, reading in print, and doing all their academic work electronically. Attitudes were consistent across three of the five statements (Table 1), but mixed in the others. For brevity and clarity, we combined strongly agree with agree responses, and strongly disagree with disagree. Figs. 2 and 3 below illustrate students' attitudes towards e-reading in comparison to before COVID by percentages.

Students' attitudes towards electronic readings compared to before COVID are mixed:

"I now LIKE electronic reading more than I did before COVID-19 restrictions."

- 49.2% disagreed (n = 115); 22.2% agreed (n = 52); 28.6% neutral (n = 67).

"I now DISLIKE electronic reading more than I did before COVID-19 restrictions."

- 23.4% disagreed (n = 55); 42% agreed (n = 98); 34.6% (n = 81) neutral.

Results show that increased dislike of e-reading is more prevalent among the younger segment of the respondents. In correlation, "like" of e-reading increased among older groups. Table 2 details these results by age groups. The number of respondents over age 34 were very few and therefore the data may not be reliable.

Earlier studies postulated that age correlations with format preference may be attributable to academic status, with undergraduates, especially lower division undergraduates, expressing a stronger preference for print than advanced students (Li, Poe, Potter, Quigley, & Wilson, 2011; Mizrachi et al., 2018). Table 3 shows the breakdown by academic status in this study.

*Likes and dislikes about print and electronic formats*

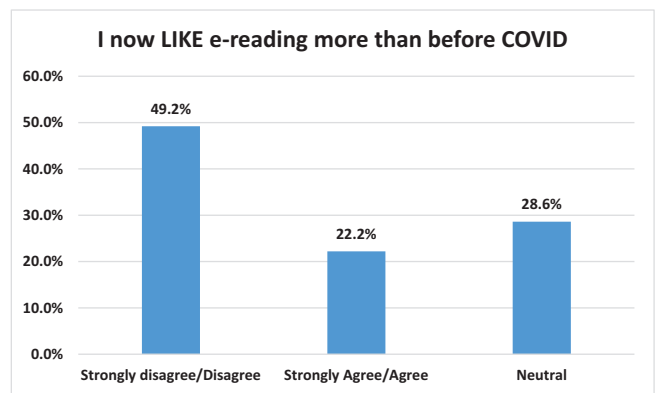
In four open questions, students listed one thing they liked and disliked about print, and one thing they liked and disliked about electronic format. Coded responses were consistent with qualitative responses from earlier studies (Mizrachi & Salaz, 2020). Table 4 lists the codes for what students liked about reading in print and electronic formats.

Selected comments favoring print:

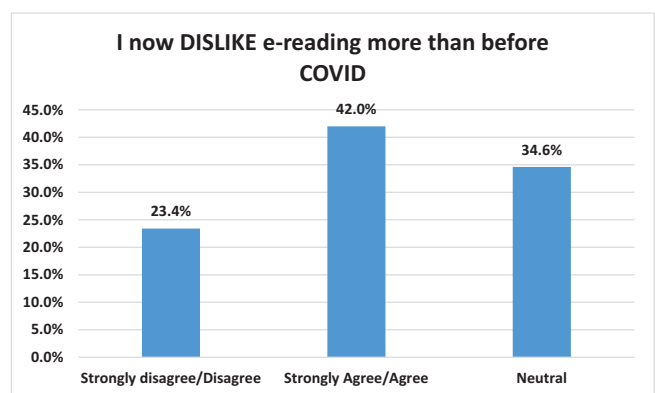
- "I can visualize pages when recalling information and physically touching pages helps [me] learn."
- "It's easier to have several books next to me while working on a paper electronically (rather than switching back and forth between tabs & windows)."
- "My eyes can actually read, I can feel the pages, it's a spiritual experience to experience print readings as a student."

**Table 1**  
Rates of agreement with feelings statements

Statement	Agree/strongly agree	Disagree/strongly disagree
"I get really tired of doing so much academic work electronically."	83.7% (n = 196)	10% (n = 23)
"I miss being able to use the library."	80.3% (n = 188)	7% (n = 16)
"I miss reading academic assignments in print."	62.4% (n = 146)	16% (n = 37)



**Fig. 2.** Percentages of students whose positive attitudes towards e-reading increased.



**Fig. 3.** Percentages of students whose attitudes towards e-reading declined.

**Table 2**  
Attitude changes to e-reading by age group.

Total n = 234	18–20 years (n = 96)	21–25 years (n = 63)	26–34 years (n = 54)	35+ years (n = 12)
% who DISLIKE e-reading more now	50%	41%	33%	20%
% who LIKE e-reading more now	18%	24%	30%	20%

**Table 3**  
Attitude changes to e-reading by academic status

Total n = 230	Undergrads (n = 158)	Graduates (n = 72)
% who DISLIKE e-reading more now	47%	31%*
% who LIKE e-reading more now	19%	21%**

\* A meaningful difference between graduate and undergraduate students.  
\*\* No meaningful difference.

Selected comments favoring e-format:

- "The convenient accessibility is what I like the most about electronic readings."
- "Perusall [management system for online group reading] lets me annotate with my classmates."
- "I don't like highlighting or writing in books, so easier to annotate and also takes up less space."



**Table 4**  
Characteristics that students like about print and electronic formats

Like print because...	Like electronic because...
Better learning engagement (highlighting/annotating)	Learning engagement features ('Find', highlighting/annotating)
Better learning quality (focus, attention)	Cost less
Health issues (easier on eyes, ergonomically better)	Less environmental waste
Physicality, tactile aspects (smell, easier to peruse)	Easier to access/Convenience
Convenience (no-tech, more portable)	Easier to organize, store
	Health and ergonomic issues (lighter weight than print, adjustable fonts)

*Reading engagement during COVID*

UCLA students reported that their overall reading engagement, as measured by highlighting, annotating and completing assigned readings, decreased during the COVID pandemic. Responding to the statement "Compared to before COVID-19, I now highlight and annotate my academic readings..." 47.4% (n = 111) reported *less* often and only 11% said more often. 38% percent (n = 89) said they completed their assigned readings for class *less* frequently than before COVID.

*Ability to focus and remember on different formats*

One question asked students to rate their ability to focus on a text when using various devices. A second question asked them to rate their ability to remember information from a reading on the same devices. Consistent with earlier studies (Mizrachi, 2015; Mizrachi et al., 2018), 81.6% (n = 191) said the use of print makes it easy/somewhat easy to focus while reading; 78.2% (n = 183) said that the use of print makes it easy/somewhat easy to remember information. Tables 5 and 6 below show comparisons between devices (neutral responses not included).

We see that despite their ubiquity, students said reading on smartphones is the most difficult medium for focus and information retention. This could be because the inherent features of the format (e.g., small screen size). A small screen requires more scrolling, for instance; a factor which correlates negatively with reading comprehension. It could be that e-reading software is not yet optimized for phone reading. If it were, the favorability of this format among this group of readers might improve.

*Physical effects*

In earlier studies, students often noted how they felt e-reading contributed to eye strain and other adverse physical effects (Mizrachi & Salaz, 2020). We asked about students' physical welfare during the pandemic because of the move to near exclusive electronic reading. As

**Table 5**  
Students' ability to focus using different reading formats.

Device (n = number of users)	Easy/somewhat easy to focus	Somewhat hard/hard to focus	Don't use for academic reading
Print (n = 234)	81.6% (n = 191)	7% (n = 16)	0%
Computer (n = 234)	20.9% (n = 49)	64.9% (n = 152)	0%
Tablet (n = 133)	30% of users (n = 40)	45% of users (n = 60)	43% of all respondents (n = 101)
E-reader (n = 81)	31% of users (n = 25)	45% of users (n = 36)	65% of all respondents (n = 152)
Smartphone (n = 125)	4% of users (n = 5)	89% of users (n = 111)	47% of all respondents (n = 110)

**Table 6**  
Students' ability to remember information using different reading formats.

Device (n = number of users)	Easy/somewhat easy to remember	Somewhat hard/hard to remember	Don't use for academic reading
Print (n = 234)	78.2% (n = 183)	3% (n = 7)	0%
Computer (n = 234)	36% (n = 84)	33% (n = 77)	0%
Tablet (n = 133)	29% of users (n = 39)	37% of users (n = 49)	43% of all respondents (n = 101)
E-reader (n = 81)	26% of users (n = 21)	40% of users (n = 32)	65% of all respondents (n = 152)
Smartphone (n = 125)	11% of users (n = 14)	63% of users (n = 79)	47% of all respondents (110)

expected, students report experiencing more adverse physical effects than before COVID.

- 85% of respondents reported experiencing more eye strain
- 56% experience more frequent headaches
- 78% experience more back, neck, or other body aches
- 49% report more frequent physical effects of an unspecified nature.

It is not possible to conclude from the data whether this was because they were reading more on e-devices than previously or other factors, but overall health can affect academic achievement.

*Internet access*

In technologically advanced countries, and especially at large residential urban institutions, it is easy to assume that students have regular access to reliable internet. However, during COVID, the campus closed and students were forced to vacate residence halls. Many moved back home and others had to find alternative accommodations. Twenty-three percent of the respondents to this survey reported variable internet issues such as no/intermittent access, slowness, or other difficulties. The difficulties they described included multiple power and internet outages, multiple household internet/device users, disturbances because of traveling/living abroad, and multiple moves since the closure of campus housing.

Selected comments include:

- "I have lost internet connection during several classes & during one final, but so far all my professors have been understanding."
- "My internet routinely fails, so it's scary to take exams and not know if my internet will crash."
- "I get kicked out of zoom meetings once a week and my wifi becomes too slow to load anything a few times a week."

*General comments*

Twenty-seven students supplied additional open comments at the end of the survey. These ranged from the succinct:

- "I hate online school."
- "Electronic > print"

To the alarming:

- "I feel like I am more stressed."
- "I am consistently distracted and do not enjoy any aspect of remote learning."
- "I have no will to do anything anymore."

Five comments expressed suggestions for, or attitudes about, the library such as requesting more digital resources: "I can only afford to live

far away from campus, so commuting to the library costs me considerable amounts of time and money. Electronic access to academic materials is an issue of equality,” and “I miss libraries because I didn't have to pay expensive prices for books.”

One graduate student observed: “Screens hurt. They hurt students' eyes, they inhibit the ability to discuss, they make absorbing information that much harder. I feel that we should all be given stipends to print our readings; especially as graduate students who have to read a lot more readings, grade a lot of student papers, as well as write our dissertations.”

## Discussion

We questioned whether the increased exposure and experience with e-formats during COVID would lead students to adapt their reading strategies accordingly and hypothesized that students might find they liked reading electronically more than before the pandemic. This was not the case for the majority of respondents. It appears that some respondents' increased experience with e-formats led them to feel more negatively than before, though it could be just an outcome of having to do everything on screens, not just academic readings.

While approximately a third of respondents reported no effect on their attitude towards e-text, the largest proportion of students, especially the younger and less experienced students, reported more negative attitudes than they held previously. These reports are notable in light of earlier studies that have found a stronger or more prevalent print preference among younger students that are earlier in their academic careers (Li et al., 2011; Mizrachi et al., 2018). The data reported here suggests that, rather than improving attitudes towards e-reading, the additional experience with and exposure to e-reading formats caused by the pivot to remote learning may have had the opposite effect; leading early-academic students to a stronger distaste for e-text. It is also possible that during COVID undergraduates spent more “class” time on Zoom than advanced students, and therefore felt the effects of increased screen time, including more e-readings, more acutely – including the internet disruptions that many respondents reported, as well as the adverse physical effects of headache, eyestrain, and other body aches that large proportions of respondents reported. Students commented on this directly in their qualitative comments.

These attitudes echo the comments by students at Cambridge University cited in our literature review (Gleeson et al., 2021). They demonstrate the difficulty of attributing apathy and negativity towards e-reading to the medium exclusively in this context. In the students' perspectives, it is the whole aspect of remote learning: exclusively online classes, online interactions with faculty and peers, online reading, and online assignments, that many students find so tiresome and difficult. Besides their academic obligations, the broader issues of the pandemic such as social isolation, health and economic worries may also affect students.

We can also see in the data that some students may not have learned electronic engagement techniques, such as how to use the highlighting and annotation features of various e-text platforms. Thus, through no fault of their own, they were unprepared to engage with the online texts as they would with print. This would be consistent with Roy and Covelli's (2021) findings cited above.

We conclude that the impact of moving to remote learning on reading format attitudes has been to increase the prevalence of dislike of e-reading among most of the students. This said, a not-insignificant proportion of students (approximately 20%) reported that they like e-reading more since the COVID pandemic. We would like to better understand what individual or contextual factors might drive the smaller proportion of students who were more favorable towards e-formats and recommend further study of e-preferring readers as a group more broadly in the future.

We asked whether students would report changes in their reading and learning engagement strategies, and found that nearly half the

respondents reported that they highlighted and annotated their readings less often than before COVID, and a large minority of nearly 40% reporting that they completed their assigned readings less often than they did before the pandemic. Qualitative responses suggest that this may be attributable, in some cases, to general difficulties keeping up with academic work in the face of personal challenges related to the pandemic and overall tiredness from spending so many hours on the screen. It may also be a result of not having access to tools that enable a comfortable digital engagement, the distractions inherent in online reading, or never learning how to use engagement tools. We note that in this area, there is a small minority of respondents, about 11%, who reported more frequent learning engagement behaviors through the pandemic. Some cited specific technological tools, such as *Perusal*, that enabled them to highlight and annotate texts not only individually, but collectively with classmates. Other authors have previously suggested that the limitations of e-reading found across studies are not necessarily fixed or impossible to overcome with the right software and hardware advancements, and/or user training (Salaz & Mizrachi, 2021). We find indications within our data, as others have found in other data sets, that e-preferring readers may be encountering tools and circumstances that lead to greater success with e-formats. Exploring these further may help us move towards a world where the advantages and affordances of print can be manifested in e-texts, allowing readers to more broadly access the convenience and affordability of e-text, without the learning, memory, and focus disadvantages that so often appear.

The data showing disengagement among large numbers of respondents is certainly a concern for quality remote learning and warrants further investigation as well. Institutions may wish to consider best practices to readers and instructors moving based on the literature, to better prepare for a range of circumstances that may require the affordances of e-text. The level of disengagement reported here may not be seen in other, less fully life-altering circumstances, but we feel strongly that strategies should be explored and considered to minimize this phenomenon in the future.

We asked whether students of different demographics and circumstances would differ significantly in their responses. We have already discussed some points of clear difference between undergraduate and graduate level respondents. Our survey also includes questions regarding employment status and caretaking responsibilities, intended to examine how factors and circumstances outside of the university may contribute to students' e-reading attitudes and behaviors. We felt that circumstances such as these reflect competing time obligations and possible variances in students' socio-economic strata that could be important to understanding reading format preferences and behaviors. Unfortunately, the small number of respondents reporting on these variables in this study made it difficult to determine any informative or meaningful group differences and therefore we have not reported on them. We have seen in previous, large-scale studies, including ARFIS, that large majorities of respondents prefer to read academic texts in print — regardless of the country they come from or its associated levels of technological development or educational systems. We believe that better identifying and articulating “intermediating” factors that could be associated with format preference, such as commuter status or others, would help individual institutions apply supports, policies and guidance related to e-reading that are most appropriate to their own populations and context.

Finally, we asked how the responses in this study would compare to pre-COVID studies of format preference and behavior. A strong majority of all students in pre- and mid-pandemic times expressed a preference for print reading overall, with those feelings strengthening through the pandemic (and corresponding dislike of e-reading also strengthening). We conclude that the pandemic has not altered the fundamental dynamic and disposition that most students have consistently reported through years of study. Most students still believe that print is the best medium for focusing and remembering information from their readings, as reported in large-scale datasets such as ARFIS (Mizrachi, 2015;

Mizrahi et al., 2018).

However, we cannot generalize that the increased dislike of e-reading is a permanent condition. It may just be a temporary outcome of the exclusive remote learning during this unprecedented time. As students and faculty become more accustomed to digital learning, it is possible that comfort levels and confidence in their ability to learn using e-readings will increase; and as instructional modalities move back towards pre-pandemic norms, it is possible that attitudes towards e-reading from this set of respondents may soften. Additional study should be pursued after returning to more in-person learning to investigate whether assigned texts in e-format have increased because of pedagogical changes implemented during the pandemic, and whether students' attitudes and behaviors persist through a return to the availability of pre-pandemic modes of instruction and text access.

#### *Practical implications*

Given the continued strong expressed preference for print formats among tertiary learners, and the associated documented experimental evidence of learning impacts associated with e-reading, we recommend that educational institutions strive to mitigate any potential negative learning or physical health impacts of e-reading on student populations. Approaches may include:

- Developing and sharing best practices and guidance for effectively engaging e-text, built on the experiences of successful users;
- Enabling students to choose print formats on an equitable basis wherever possible, by providing print-on-demand or print-text options that cost no more than e-text options.

For Libraries specifically, we recommend seeking to balance the affordances of print and digital formats in acquisitions and collection curation decisions, and where possible, favoring e-resources with printability or print allowances, as with many e-book platforms and providers.

#### *Limitations*

While gathering data from a single institution has the benefit of fully understanding the policies and local health contexts behind the data, we recognize the limitations of presenting data from one institution. We would have preferred to conduct a much broader study of students from many different types of post-secondary institutions throughout North America: community colleges, tribal colleges, liberal arts schools, and public and private colleges and research institutions of all sizes, which was impossible due to logistical hurdles on a short timeline. Although the pandemic conditions have evolved, we have shared our questionnaire to enable reuse in the future.

We also note that the population studied comes from an institution that focuses on in-person instruction, particularly at the undergraduate level. We have not specifically looked for or compared data from exclusively online degree programs, which have grown in number globally over the years; in fact, based on our literature review, we feel that this is an understudied area generally.

The response rate and self-selection bias inherent in survey data should be considered when interpreting results as well. While the initial selection of invitations was a random sample, it is possible that respondents with stronger feelings, either positive or negative, were more inclined to take the survey. Self-selection bias in surveys is a known phenomenon and results in a sample where some demographics are over- or under-represented against the total population. For example, 56.4% of respondents in this study identified as female, while only 52.9% of enrolled students at this institution in Fall 2021 identified as female. Prior reading format preference studies such as ARFIS similarly reported an over-representation of female-identifying respondents (Mizrahi et al., 2018). The final respondent demographics do not

perfectly represent those of the general population, and this should be considered in the interpretation of findings.

Our data gathering occurred during March and April 2021, exactly a year after pandemic restrictions and the switch to remote learning began. Many institutions have continued to evolve operations and hybrid learning approaches since then. Thus, while results from this study provide important insights to students' reading format attitudes and behaviors during the COVID pandemic, it is limited to a sample population from just one post-secondary institution in the United States at a certain point in time. By comparing it with results from other institutions, a broader understanding can be reached.

#### **Conclusion**

Data generated from this study indicates that remote pandemic education conditions at a major U.S. research university resulted in shifts in tertiary learner attitudes towards e-reading; a plurality of them more negative, but did not alter the fundamental conclusion of prior literature that majorities of tertiary learners prefer to read academic texts in print.

We concluded that undergraduate students were somewhat more likely than graduate students to report negative shifts in attitude towards e-reading, but that other demographic differences either do not exist or cannot be discerned from this data set.

While some positive shifts were also uncovered, large numbers of respondents reported perceived negative health and learning impacts associated with the amount of screen-reading they were doing, both general and academic. Large percentages of learners reported completing assigned academic readings less frequently during the pandemic, and highlighting and annotating their texts less frequently. Small minorities of learners reported more favorable experiences and we recommend further study to understand what tools, techniques, or circumstances may be predictably associated with improved attitudes and outcomes with e-formats.

Some of the factors behind these shifts in attitude and behavior were elucidated in qualitative responses. We discovered disparities in access to technology and reliable internet among respondents indicating that some have been disadvantaged by exclusive remote learning. Students with certain disabilities as well as commuters and students with competing time obligations however, appreciated the flexibility that e-learning and/or e-reading allowed them. Other students reported positive experiences with technological tools that enhanced engagement with e-text and with their peers. We recommend continuing to explore and address these factors and the nature of positive engagements with e-text in order to develop and sustain equitable learning experiences for all readers.

As the immediate life challenges associated with COVID-19 ease and classes return to in-person learning, students may or may not be more receptive to e-reading than they were before or during the pandemic. We recommend continued monitoring of the longer-term effects of increased exposure to and experience with e-text, as well as reduced overall screen time associated with learning exclusively on Zoom. On a practical level, we recommend that educational institutions and libraries strive to support learners by providing training and guidance on best practices for using e-text, providing routes to access print for those who wish to elect it on an equitable-costs basis, and seeking/pursuing e-books and e-resources that are licensed to allow for printing out full or partial portions of text.

Further study is recommended to fully understand the effects of this unprecedented phenomenon on tertiary students and to further hypothesize how changes in attitude could be influenced through training, technological development, or other circumstantial factors. In the post-pandemic era, libraries and educational institutions will need to decide how the new reality will affect acquisition and instruction decisions for print and electronic formats to best serve the needs and interests of our students. To do so, it is vital that we keep informed of our students' preferences and behaviors.



**CRedit authorship contribution statement**

**Diane Mizrachi:** Conceptualization, Methodology, Investigation, Supervision, Writing – original draft. **Alicia M. Salaz:** Conceptualization, Methodology, Formal analysis, Data curation, Writing – review & editing.

**Data availability**

Data will be made available on request.

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**Appendix A. Reading format attitudes during COVID survey****1. Please choose the answer that best describes your learning mode. (required)**

In Fall 2020, my academic classes were held:

Exclusively remote    Mostly remote    Half remote/half in-class

Mostly in-class    In-class only    Not relevant

In Spring 2021, my academic classes are being held:

Exclusively remote    Mostly remote    Half remote/half in-class

Mostly in-class    In-class only    Not relevant

**2. Please indicate the answer that best describes your feelings: (required)**

I now LIKE electronic reading more than I did before COVID-19 restrictions.

Strongly agree    Agree    Neither agree nor disagree

Disagree    Strongly disagree

I now DISLIKE electronic reading more than I did before COVID-19 restrictions.

Strongly agree    Agree    Neither agree nor disagree

Disagree    Strongly disagree

I miss reading academic assignments in print.

Strongly agree    Agree    Neither agree nor disagree

Disagree    Strongly disagree

I miss being able to use the library.

Strongly agree    Agree    Neither agree nor disagree

Disagree    Strongly disagree

I get really tired of doing so much academic work electronically.

Strongly agree    Agree    Neither agree nor disagree

Disagree    Strongly disagree

**3. Before the COVID-19 restrictions, approximately how much of your academic readings did you do in print (including printouts) and electronically (all devices)? (required)**

Print:    All    Most    Evenly split    Some    None

Electronic:    All    Most    Evenly split    Some    None

**4. Today, during the COVID-19 restrictions, approximately how much of your academic readings do you do in print (including printouts) and electronically (all devices)? (required)**

Print:    All    Most    Evenly split    Some    None

Electronic:    All    Most    Evenly split    Some    None

**5. Consider all the academic reading that you now do, both in print and electronically. (required)**

Compared to before COVID-19, I now highlight and annotate my academic readings:

More often    The same amount    Less often

Compared to before COVID-19, I now complete my assigned readings for my coursework:

More often    The same amount    Less often

**6. Consider all the academic reading you do now ELECTRONICALLY. (required)**

Compared to before COVID-19, I now highlight and annotate my ELECTRONIC readings:

More often    The same amount    Less often

Compared to before COVID-19, I now complete my assigned ELECTRONIC readings for my coursework:

More often    The same amount    Less often

7. You may be able to focus more on your reading (e.g. not get distracted or multi-task) when using some media more than others. Please indicate your ability to focus when using each of these media for academic readings. (required)

	Easy to focus	Somewhat easy to focus	Neutral	Somewhat hard to focus	Hard to focus	Don't use for academic reading
Print						
Computer						
Tablet						
eReader						
Smartphone						

8. You may find you remember more of what you are reading when using some media more than others. Please indicate your ability to remember when using each of these devices for your academic readings. (required)

	Easy to remember	Somewhat easy to remember	Neutral	Somewhat hard to remember	Hard to remember	Don't use for academic reading
Print						
Computer						
Tablet						
eReader						
Smartphone						

- 9. What is the one thing you like most about academic readings in print? (required)
- 10. What is the one thing you like least about academic readings in print? (required)
- 11. What is the one thing you like most about academic readings on an electronic screen? (required)
- 12. What is the one thing you like least about academic readings on an electronic screen? (required)
- 13. Compared to before COVID-19, I now notice the following physical effects from reading academic texts on an electronic screen: (required)

	More often	Less often	Same frequency	N/A Never Experience
Eyestrain				
Headaches or Migraine				
Neck, back, or other body aches				
Other physical effects				

The following information will help us understand your external circumstances while pursuing your academic program.

14. Please select all of the electronic devices you use for your remote learning.

Computer    Printer    Smartphone    Tablet    eReader    Other

15. Do you share any of these devices with family members or others?

No    Yes — Please specify the device:

16. Have you borrowed any electronic devices from your institution during the COVID-19 pandemic for your remote learning needs?

No    Yes — Please specify the device:

17. Do you have reliable Internet access at your main residence?

Yes    No    Optional comments:

18. Are you simultaneously employed while enrolled in your academic program?

No    Yes — less than 10 h/week    Yes — 10–19 h/week

Yes — 20–40 h/week Yes — over 40 h/week Optional comments:

**19. Do you have any primary caretaking responsibilities (30 h a week or more) while enrolled in your academic program?**

No Yes Optional comments:

**20. What is your age by year? (Make a selection)**

**21. What is your academic status?**

Undergraduate Graduate Post-grad  
Professional School (health, medicine, law, education, business, etc.) Certificate program  
Other

**22. If you are an undergraduate, please indicate your year: (Make a selection)**

**23. Which best describes your academic major or field of study? Check more than one if you are studying for a double major or in a cross-disciplinary field.**

Arts Humanities Social Sciences Life Sciences Physical Sciences  
Mathematics/Engineering/Technology Undeclared Other

**24. With which gender do you identify most? (Make a selection)**

**25. What is the name of the college or university where you are enrolled?**

**26. In which country is your institution located? (Make a selection)**

**27. We welcome any additional comments you would like to make about reading in print or on an electronic screen for your academic work.**

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