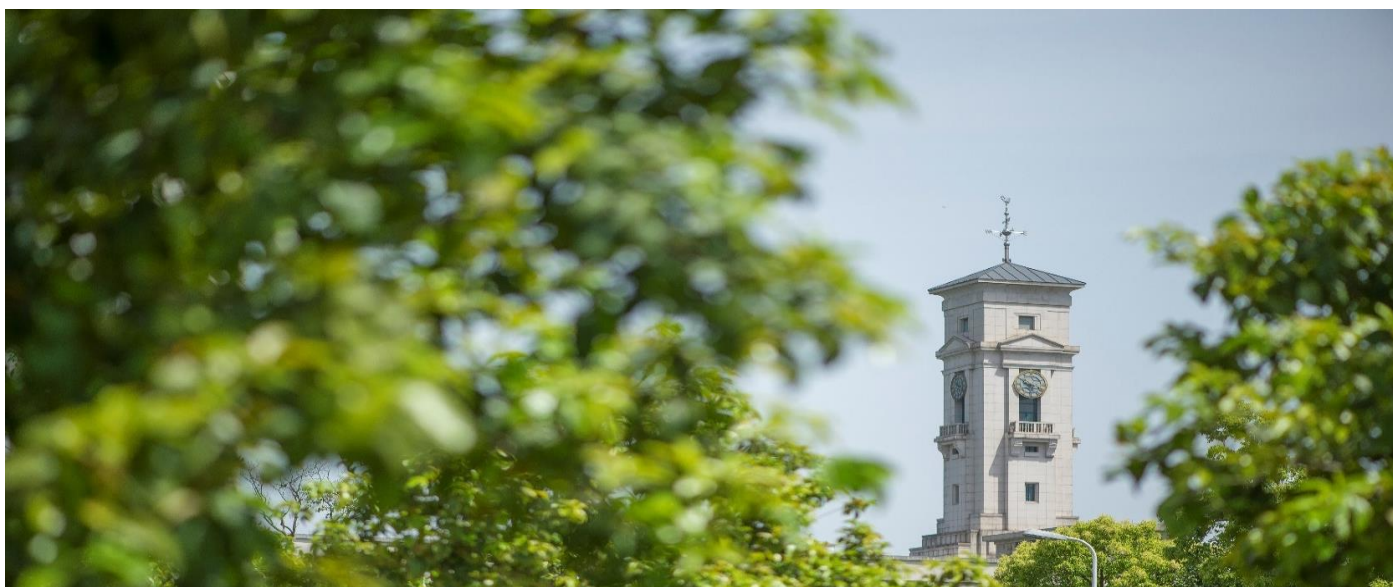


# Engineering student attitudes to e-reading in remote teaching environments

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First published 2020

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# Engineering Student Attitudes to E-Reading in Remote Teaching Environments

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**Abstract— Rational:** Academic libraries are increasingly offering online e-books because they provide convenient access for students, cost savings, logistical advantages and significant portability. Current research suggests that this trend will continue in the future. In parallel with the growth of the e-book market and the development of e-book library collections, librarians and information scientists have conducted a number of research studies to investigate the impact of e-books on collection development: specifically, relating to the challenges and questions of e-book management and service. Consequently, researchers have considered it pertinent to explore the behaviours and strategies of e-book readers.

**Scope:** In January 2020, institutions around the globe faced significant disruption due to COVID-19. Many universities accelerated their adoption of online/e-learning approaches in response to the COVID-19 epidemic. Though e-books were at an early stage of adoption and the culture of using them in academia was slowly growing, they suddenly became the preferred option, if not the sole option because libraries were closed. Accordingly, some of the popular publishers; for example, Cambridge University Press, have offered online higher education textbooks as free-to-access. Over 700 textbooks were available for more than 2 months, regardless of whether those textbooks had previously been purchased. Furthermore, MIT Press offered complimentary access to its catalogue of e-books to support faculty and students who were working and learning remotely.

**Methodology:** Despite increasing interest from librarians and learning technologists, prior to 2020, there were few well conducted studies investigating the habits of e-book users, especially amongst engineering students. Notwithstanding the challenges arising from the COVID-19 pandemic, an opportunity has arisen to survey student attitudes regarding the adoption of e-reading in an academic context. In this paper, a case study is presented that investigates the impact of the mandatory use of an e-book textbook in a final year undergraduate engineering module at the University of Nottingham Ningbo China. The paper investigates Science and Engineering students' usage and attitudes towards e-books when using their available e-readers, which include PCs or portable devices. A cross-sectional survey containing 5 nominal questions, 2 open questions and 17 Likert questions was developed and deployed to final year students from two programmes: Electrical and Electronic Engineering and Mechatronics Engineering. These students were attending the module titled Integrated Circuits and Systems.

**Findings:** The results of this study highlight approaches for improving support for e-reading in an academic environment.

Of particular interest to librarians are student attitudes after their adjustment to e-books, which have implications for future purchasing decisions. Furthermore, student strategies for adjusting their learning techniques as a result of forced engagement with e-books illustrate preferences that can inform educators.

In conclusion, the forced adoption of e-books has presented the opportunity to investigate student acceptance and strategies. This research provides evidence for purchasing decisions and strategies for adopting e-books in wider Higher Education syllabi.

**Keywords—** E-reading, E-book, Engineering education, Textbook, E-learning

## I. INTRODUCTION

The coronavirus outbreak, later known as COVID-19, became a serious issue in China during December 2019 [1]. By January 2020, the pandemic had raised considerable concern within China. Strict measures were immediately implemented by the Chinese government that included restriction on people's migration, which led to an extension of the national holiday, and winter vacation of all schools and universities. This placed major challenges on both institutions and students, firstly in China, and later internationally when COVID-19 was announced as a global pandemic [2]. In order to face the challenge, the University of Nottingham Ningbo China (UNNC) implemented remote teaching after firstly extending the winter break by two weeks. The university library helped students by providing e-books as replacements of physical textbooks because no students were allowed to return to campus during the majority of the spring semester. Module convenors were also encouraged to offer more reference choices to the library to expand the electronic reading list. All e-books provided by the library were available on the university library platform NUsearch, with an option to integrate a specific reading list of a module into the learning management platform, which is Moodle [3].

In this paper, a survey was developed that was based on the findings of a specific study to investigate UCLA undergraduates' reading format preferences, and a more global study among university students worldwide [4, 5].

This paper is structured as follows: Section II gives an overview of the literature review. Section III introduces the methodology. Section IV presents the students' survey and reflects on the findings, and Section V concludes.

## II. LITERATURE REVIEW

In recent years, e-reading has seen widespread adoption, especially in consumer/leisure contexts with the introduction of dedicated e-reading devices such as Amazon's Kindle<sup>1</sup> and the Nook<sup>2</sup> by Barnes & Noble. It is expected that this trend of adoption will continue in the coming years [6]. E-reading has a number of advantages over traditional print media, including cost, portability, instant availability of content, inline digital notetaking, backlit reading, customizable font and layout, accessibility features and the ability to easily copy or quote materials [5-8]. Despite its numerous advantages and the promise of widespread adoption, the enthusiasm for e-reading in the education sector has been underwhelming, to date [9]. A number of studies have set out to investigate why students, in general, tend to prefer traditional printed reading materials over e-reading.

The context in which the reading occurs has been found to affect student's preference of reading medium. Students reported a preference for e-reading materials that are shorter, and leisure focused [7, 10]. Numerous studies have reported a preference amongst students, at all levels of study, for reading lengthier, academic materials in printed form [5, 7]. Preference for e-reading appears to be informed by level of study, with Wang and Bai reporting that senior undergraduates were more likely to utilise e-reading for academic pursuits relative to their fellow junior peers [7]. Similarly, Lamothe reported doctoral students to be the biggest user groups of electronic resources and most likely to utilize them for academic purposes [8]. Awareness of the availability of e-resources is another relevant factor for consideration in this discussion, with research generally indicating that the majority of students are aware of the availability of e-books through their libraries. However, studies have indicated that faculty staff might be less likely to advertise or promote the availability of e-books for their courses [11, 12].

A number of usability studies have investigated e-reading behaviours. Navigating e-books has been highlighted as unsatisfactory by students with many citing the ability to quickly "flick" or "skim" through material to identify relevant content as being lacking in e-reading environments [9]. Navigation in e-reading contexts remains an active area of research in the *human computer interaction* (HCI) community to date [13]. Furthermore, human factors that include eyestrain, distractions and familiarity with the relevant technologies are compounding factors that detract from the e-reading experience [14]. Mizrachi et al. performed a large (10,000+ students) worldwide survey of student reading format preference [5]. The survey found that there was little relationship between the student's country of origin and the stated preference of reading format. Mizrachi et al. also contributed a multi-faceted survey to interrogate reading preferences in an academic context, the basis for which we use in the work presented in this paper. To the best of our knowledge, no existing studies have explored the response

and attitudes of students to a situation where they are required to utilise e-reading resources, as was the situation that resulted from the COVID-19 pandemic. The novelty and contribution of the study presented here includes the impact of circumstance on student attitudes to e-reading when volition has been restricted.

## III. METHODOLOGY

In this paper, a survey consisting of four dimensions was given to final year engineering students attending an optional module. The survey was developed based upon a specific study that was used to investigate UCLA undergraduates' reading format preferences, and a more global study among university students worldwide [4, 5]. A specific dimension of this study was dedicated to investigating the impact of disruptive education on the students' reading behaviours.

Students answered questions on four different themes, including format preferences, learning engagement, language influence on material format, and the impact of COVID-19 on their reading behaviour. The survey consisted of 17 Likert questions, 5 nominal questions and 2 open questions. The questionnaire was given to all 23 students enrolled in the module and it was completed by 16 participants. This reduction in responses was considered to be due to normal questionnaire attrition.

The survey was built and analysed using Qualtrics. The invitation to participate in the survey was sent to all students as an announcement on MS-Teams. A reminder was also sent through the students' class representative to encourage greater participation. The responses were analysed using simple statistics together with the student responses from the open question fields to derive meaning from the results.

## IV. FINDINGS

The survey questionnaire responses are categorized according to theme and will be described in the following paragraphs.

### A. Format Preference

The investigators were firstly interested to know if students would prefer to read the teaching material in printed format and whether this had subjectively affected their comprehension. Using a Likert scale question, students were asked to respond to the following statements (with 10 for highly likely and 1 for least likely):

I prefer to have my course materials in print format.

It is more convenient to read my assigned readings electronically than to read them in print.

I remember information from my course better when I read them from printed pages.

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<sup>1</sup> Amazon Kindle - <http://amazon.com/kindle>

<sup>2</sup> Nook by Barnes & Noble - [https://www.barnesandnoble.com/b/nook/\\_/N-1pbl](https://www.barnesandnoble.com/b/nook/_/N-1pbl)

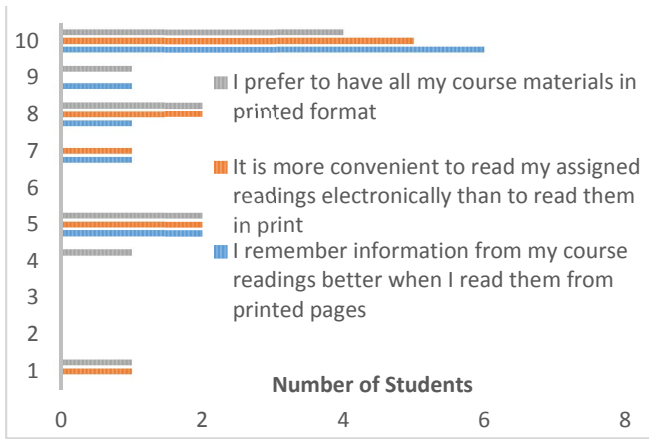


Fig. 1 Course material reading preference

Fig. 1 demonstrates that students felt that they remembered more information when reading from printed pages; however, students simultaneously appreciated the convenience of e-readers. Against this juxtaposition, it was interesting to see that students preferred to have printed course materials as opposed to using the e-books.

In an intervention designed to investigate the influence of reading length on the preferred reading format, the students were asked for their responses to the following two statements:

If an assigned reading is 7 pages or more, I prefer to read it in printed format.

If an assigned reading is less than 7 pages, I prefer to read it electronically.

Fig. 2 shows the response of the students. These responses were consistent with previous studies showing the preference of having electronic readings of shorter length [4, 15]. The preference for reading texts of greater than 7 pages was inconclusive based on this data.

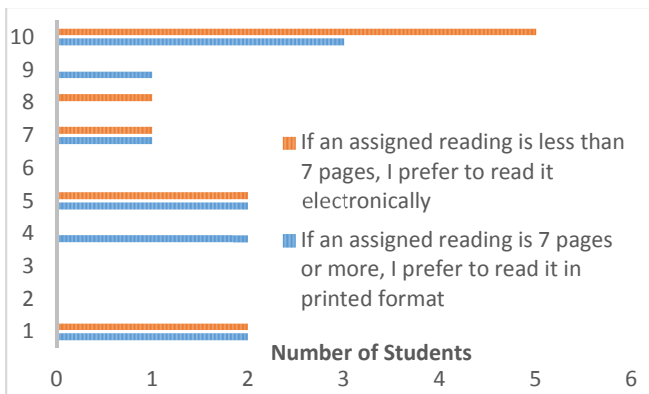


Fig. 2 Influence of document length on reading format

In a second intervention that attempted to generalise the previous result and also to understand the effect on reading comprehension, the students were asked to give their response to the following statements:

I prefer electronic textbooks over printed/physical textbooks.

I can focus on the material better when I read it in print.

I prefer to read my course readings electronically.

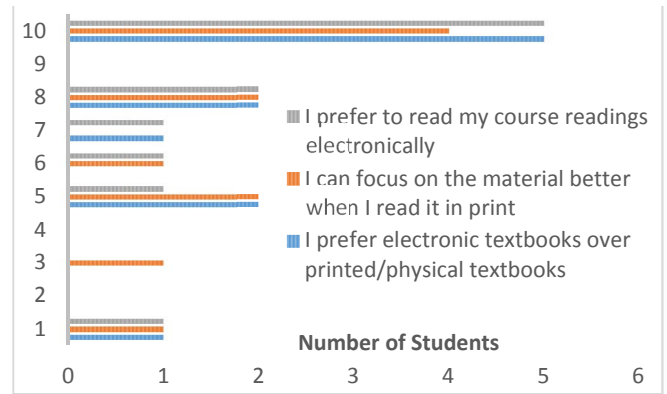


Fig. 3 Preference of electronic readings over printed document

In Fig. 3, it can be seen that some students indicate that they can better focus on printed material as opposed to e-books; however, they preferred to have both their course readings and their textbooks available to them electronically. This could possibly be because they prefer to store them electronically and read them in print. It is interesting to note that there are few discernible differences in the responses to the questions.

### B. Learning Engagement

In order to investigate the influence of the reading format on learning engagement, the students were asked the following Likert scale questions:

I usually highlight and annotate my printed course readings.

I usually highlight and annotate my electronic readings.

The response is shown in Fig. 4, which shows that students are similarly motivated to annotate both. It was expected that the *search option* of all electronic readers would reduce the annotation on these devices, but it appears that the decision to annotate might be due to the learning preference of the student and not due to the medium used to read.

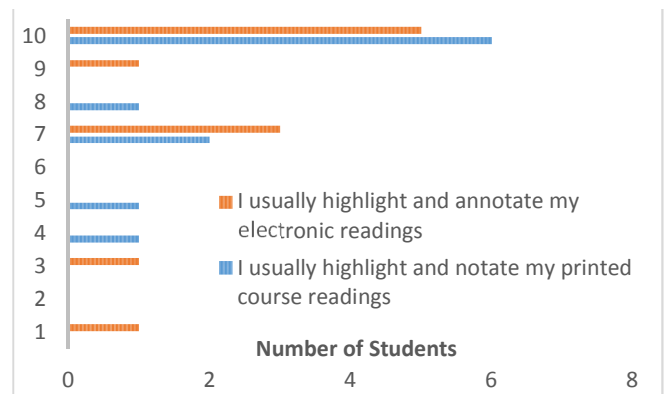


Fig. 4 Annotation of readings

In order to investigate if having both the print and electronic reading formats would subjectively improve learning efficacy, the students were asked to provide their response to the following two statements:

I prefer to print out my course readings rather than to read them electronically.

I like to make digital copies of my printed course materials.

The response is illustrated in Fig. 5 in which the students appear mildly more motivated to make digital copies of

printed course material than printing electronic materials. What cannot be understood is why students make digital copies of printed media and print digital media. In Section IV.A it is suggested that students like to store course materials digitally for convenience and then some like to print those materials for learning. However, this is merely an assumption that warrants further investigation.

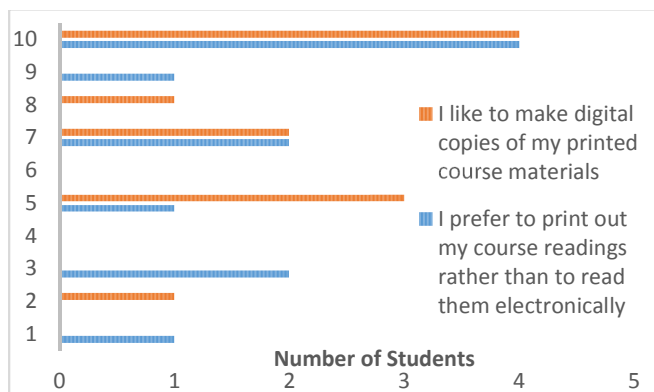


Fig. 5 Students preference of having both of the in print and electronic formats

### C. Language Influence

To investigate the effect of the reader's language on the media preference, the students were asked to give their responses to the three following statements:

I prefer to read course readings which are in my native language in electronic format rather than in printed format.

I prefer reading foreign language material in printed rather than electronic format.

My preferred reading format, either electronic or printed, depends on the language I am reading.

Fig. 6 clearly shows that students strongly prefer e-reading of their learning material when it's offered in their native language. On the other hand, student preferences were divided on the choice of media when reading foreign language material.

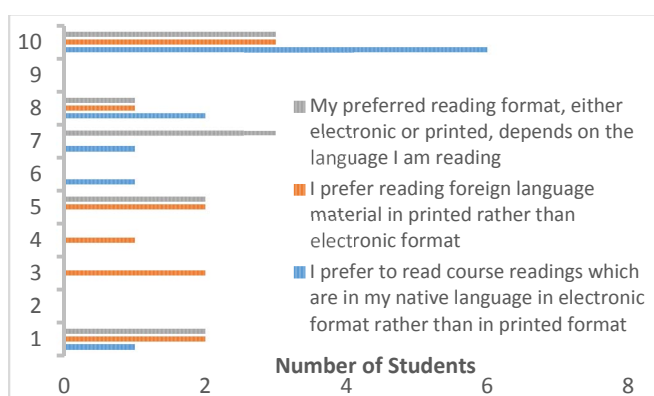


Fig. 6 Influence of language on the preferred reading format

### D. Impact of COVID-19 on Reading Behaviour

To understand the changes in students' reading behaviour due to the COVID-19 outbreak, a fourth theme was included in this study that posed five questions. The students were asked:

On average, how often did you use an e-book this semester?

The response of students to this question is shown in Fig. 7. It was found that 56% of the students used their e-book daily, 27% used e-books twice a week and 10% used them occasionally. It is assumed that the high engagement with e-books was because of the limited availability of a physical book.

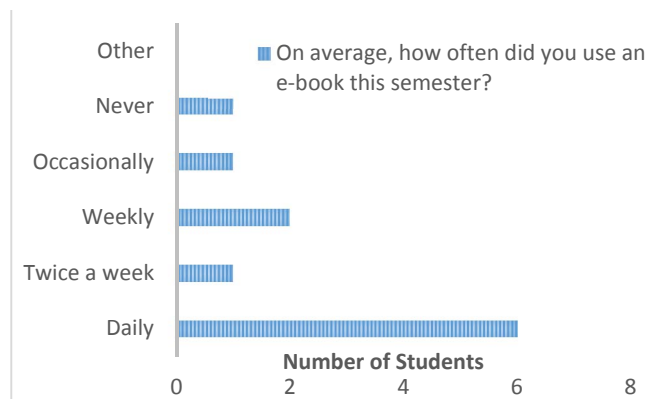


Fig. 7 Frequency of usage of e-books during the outbreak

To emphasise the change of reading behaviour during the COVID-19 outbreak, the students were asked to give their response to the following statement on a Likert scale:

The COVID-19 situation required that I change my reading behaviour to be more e-reading centric.

The response to this statement is shown in Fig. 8 in which, 73% of the students strongly agreed and ranked the statement between 7 and 10, with more than 36% of the students responding with a rank of 10.

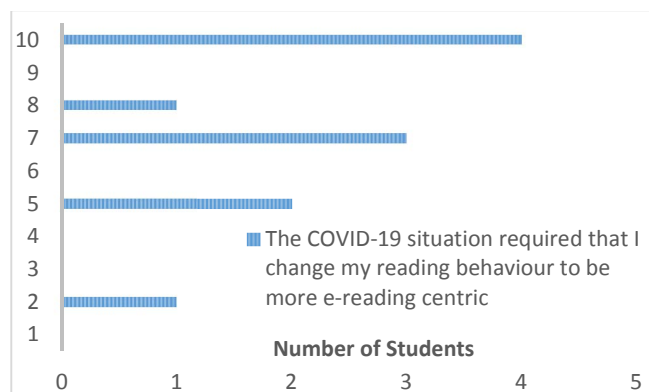


Fig. 8 Transfer to e-reading due to COVID-19

In an open question designed to investigate how students discovered e-books and how they accessed them, the students were asked:

Please tell us what resources you would use to find an e-book?

According to their responses, students mainly preferred to use *Google*, *Baidu*, or the university library search engine: *NUsearch*. Some students would ask senior students, their friends or use Moodle.

To investigate if students intended to continue using e-books after they returned to campus, despite the availability of physical books in the library, the students were asked the following three questions:

Have you returned to campus?

Have you continued to use e-books?

Do you intend to continue to use e-books when you return?

The response is shown on Table I.

TABLE I. USAGE OF E-BOOK AFTER CAMPUS RETURN

Survey Question	Yes	No
Have you returned to campus?	72.73%	27.27
Have you continued to use e-books?	100%	0%
Do you intend to continue to use e-books when you return?	66.67%	33.33%

It was found that all students who had returned to campus by the time this survey was distributed had continued using e-books despite physical books being available in the library. Table I indicates that the majority of the students who were still offsite said they would continue to use e-books; although, these results cannot discover if a change in attitude had occurred.

Finally, the investigators were interested in discovering student opinion for the purposes of informing future policy. To this end, the students were asked:

If you were given an e-reading device (for example, a Kindle) would you prefer to use that instead of using a physical textbook?

The response to this question is shown in Fig. 9.

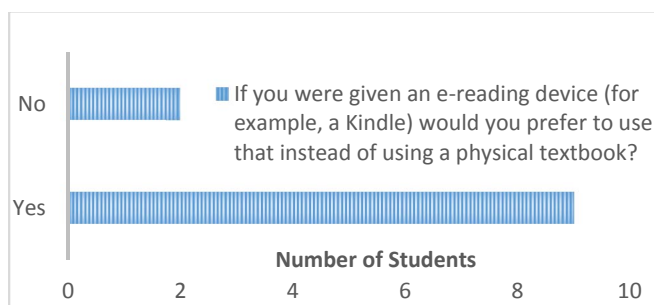


Fig. 9 Students' view of e-books replacing physical textbooks

In this case, the majority of the students (~82%) would prefer to use e-readers; however, this investigation had no pre-disruption data hence it is not possible to predict how students might have answered before COVID-19. It is not inconceivable that student answers were swayed by the thought of receiving a free Kindle.

## V. CONCLUSION

The paper has outlined the understanding that has come about from a series of sudden changes brought about by unpredicted circumstances. The students' attitudes to electronic reading have been investigated during a semester where their normal way of study was interrupted and remote teaching became a necessity.

The findings have suggested that engineering students do not have a preference for a specific type of reading media. The results indicate that the students appear to be evenly divided between those who prefer e-books and those who prefer physical media. Hence, future policy makers ought to make provision for both types of media in libraries. It can also be seen that students are likely to digitise their physical media and might print digital media for the purpose of reading, depending on their preferences. This is understandable if students are working from a frame of convenience. It is simple to store course materials on a cloud, which improves accessibility and possibly safety. Then, when necessary, those materials can be printed. Few students indicated that they would not use a Kindle if they were provided with one, but this remains an avenue of further investigation without current conclusion.

One threat to validity is that students were sympathetic and may have given high evaluations because of the abrupt change difficult circumstances. However, the results indicate a subtle shift in student attitudes towards electronic reading, which is a phenomenon to be monitored in the post COVID-19 future.

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