

Impact On Exam Performance Of Undergraduates When Learning Through Print Books Vs E-Books

Nallainathan Senthuran¹, Indang Ariati Binti Ariffin², Ali Khatibi³, Jacqueline Tham⁴

¹Doctoral Candidate, Postgraduate Center, Management and Science University, Malaysia

²Associate Professor, Management and Science University, Malaysia

³Professor and Senior Vice President, Management and Science University, Malaysia

⁴Associate Professor, Management and Science University, Malaysia

Abstract

This paper examines the role of different modes for learning Undergraduate Learning and the impact it would have on the Exam performance and Retention by the students. Quality and Sustainable Education is key aspect of the current United Nations Sustainable Development Goals (SDG). Exam performance is higher on print books by 12.65% than e-Books and Retention is 7.37% higher on print books compared to e-Books. The requirement for repetition of reading to grasp the material is higher on e-Books and therefore this will reduce the effective retention and exam performance of students aggravated by reducing the effective time due to repeated learning. This paper concludes with lower exam performance and retention from e-Books and therefore recommends libraries not to force or promote e-Books at least for text books to be studied on print medium to enrich and preserve next generation's intellectuality and academic potential. This opens e-Book companies to improve their product with higher retention and exam performance capabilities.

Keywords: e-books vs print books; exam performance; improved reading mode; theory of reading; effectiveness of e-books

Introduction

The retention ability of the students is dependent on the choice of reading mode (Olivier et al., 2019) where significant decline on retention is posed when using electronic mediums for reading opposed to their print counterparts (Guren et al., 2021; Robinet et al., 2014). This poses risk on the showcasing of undergraduate student's potential, especially in Asian countries where most of the university examination performance is dependent on retention (Ranaweera, 2016; Wong, 2004). Regardless of the understanding and studies with regard to retention, comprehension and understanding of electronic mediums of books (Myrberg, 2017; Pardede, 2008), there are no studies researching the direct impact on exam performance among

students if e-Books are utilized (Kaari, 2021). This paves up the way to research and understand the impact on exam performance when different modes of reading essentially e-Books and print books are utilized among university undergraduates (Al-Jarf, 2021; Dinkins, 2021).

The problem is further aggravated during the Coronavirus impact among the world which led to social distancing and closing down of on-site premises including libraries and bookstores (Kyodo, 2020) insisted students to turn out for electronic medium, but this was utilized as a chance by the libraries as well as electronic book companies to promote and disrupt the existing print book market with e-Books (Gamage et al., 2020; Yang et al., 2021)

where certain library networks even completely scrapped the print book editions and resorted to a purely e-Book based library equipped with e-Readers for the students (KarakoçÖztürk, 2021; Samanta, 2020) though the gravity of the action was not understood which could be as worse as reduced social intellectuality and knowledge due to lower retention (Tavares, 2022), comprehension and understanding among the subject when reading through e-Books (Acosta, 2022; Yeckehzaare et al., 2022).

Literature Review

e-Books were introduced more than five decades back which eventually started to replace the existing print books market (Augustyn, 2020) which led the customers adopt and accept e-Books as an alternative to print books (Kumbhar, 2018; Vithana, 2016) despite findings which suggested electronic medium provides comparative lower retention to students on the subject (Olivier et al., 2019; Azam & Yusoff, 2020; Johar et al., 2020), requires the student to re-read the same content again and again to achieve the same level of proficiency in the subject (Riquelme Gil, 2017), reduces the students ability to comprehend and recall the subject while also inhibiting their ability to understand of the text written in the book (James, 2019) and eventually limiting the active student learning hours per day due to the eye strain caused by electronic reader screens which causes computer vision syndrome (Pham et al., 2022).

This essentially opens up for scrutiny whether the e-Books are doing good for the students with its lower cost and easily availability (Lynch, 2013), or much worsen side effects being present which outweighs the benefits. Regardless of the early adoption and being in the market for more than five decades and being dominated by larger corporate giants such as Amazon through Kindle e-Readers (Spatz, 2018) the utilization and adoption of e-Books are lower as print books outsell ten times compared to e-Books even today (Handley,

2019), while preference of utilizing e-Books were comparatively lower as students prefer print books (Casselden, 2020). Enabling researchers to dive into and understand the reasons hidden behind the inability of e-Books to win the hearts of readers and students.

Clearly visible paradigm shift from print books to e-Books was seen during COVID-19 era and such shift is still sustained (Samanta, 2020) and forcing print book willing students to shift for e-Books was prevalent (Gamage et al., 2020) without considering the preference of the students who wish to read from print books, which is a significant portion (Richter, 2021) and not considering the impact such action could have on the society due to the in the long-term due to the absence of studies in that area. To-date the studies onto the area of the effectiveness of e-Books among students opposed to print books is very limited while the coverage of exam performance of students when utilizing a specific mode of reading is completely absent (Budi Santoso et al., 2018; Ab Yajid et al., 2020; Ariffin et al., 2020).

Methods

The best person to assess and provide accurate comments on different reading modes and its impact on their exam performance would be the students themselves, based on the fact that the patient would know better of their own disease than the doctor (Schneider et al., 2016). Hence the questionnaire was developed targeting the students who themselves are required to comment on their experiences with e-Books and print books utilizing during their undergraduate years.

The questionnaire was adapted based on the developed conceptual framework for this research which was initially went through subject expert review and appropriate amendments performed followed by pilot study among forty participants for reliability and validity testing of the questionnaire and appropriate item deletion

and similar amendments were done before finalizing the questionnaire.

Final questionnaire (Appendix 1) was issued among the target population of this study which is defined within the sampling frame of this research as Sri Lankan University Undergraduate students and through proportionate simple random sampling to cover all undergraduates enrolled within the seventeen universities of Sri Lanka (UGC, 2022). Digital medium was utilized for issuance and collection of questionnaires which was distributed with consideration to the response rate at 38% (Décieux, 2022) with an aim to cover the expected respondents to be able to generalize the study of the sampling frame consisting of 153,497 (UGC, 2022) through respondents of 384 (Krejcie & Morgan, 1970).

Data analysis was performed utilizing IBM Statistical Package for Social Sciences (SPSS) for descriptive statistics and inferential statistics including reliability and validity testing in addition to Pearson's Chi-square and relationship between variables testing and their strength for the purposes of hypotheses testing followed by one sample T-Test for calculation of the p-values and defining statistical significant different groups followed by confirmation of the research design using AMOS software package for confirmatory factor analysis and looping of error terms based on modification indices to arrive at the final acceptable model satisfying model fit indices (Azam et al., 2021).

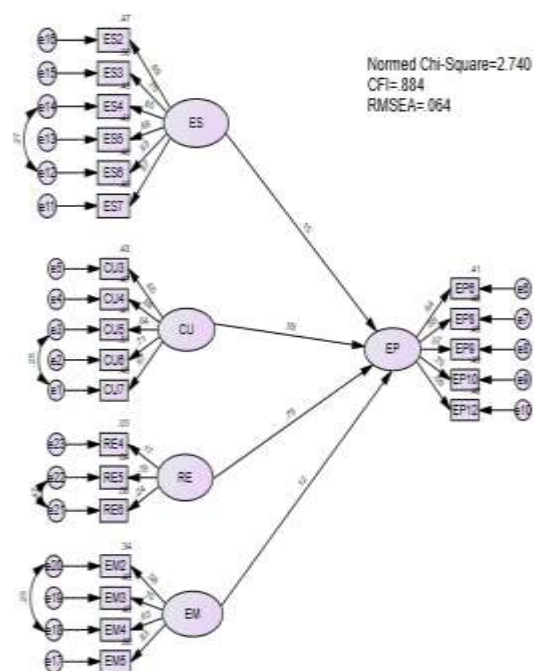


Figure 1: Structural Model

Figure 1 depicts the structural model of the research as a whole while independent construct findings will also be utilized to support the hypothesis proposed on this paper.

Findings

The below table depicts the initial testing values of this research which clearly explains the relationship between comprehension, understanding and retention are key contributors of exam performance among students while each comprehension and understanding contribute 52.6% positively towards the exam performance whereas retention contribute positively at 59.8% towards exam performance evidenced through Table 1 consisting of static evidences.

This requires in-depth study onto the retention and exam performance variables and the impact on them when utilizing e-Books and print books according to the below Table 1.

Table 1: Statistical Testing Results

	Estimate	S.E.	C.R.	P	R2
EP ← ES	.118	.040	2.980	.003	.153
EP ← CU	.526	.064	8.173	***	.588
EP ← RE	.598	.399	<u>4.011</u>	***	.785
EP ← EM	.084	.036	2.322	.020	.120

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and the impact on them when utilizing e-Books and print book.

Retention

Table 2: Retention t-Test

	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Print Books	67.302	422	<.001	<.001	3.638	3.53	3.74
e-Books	62.148	422	<.001	<.001	3.388	3.28	3.49

Table 3: Retention Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	101.402 ^a	16	<.001
Likelihood Ratio	102.627	16	<.001
Linear-by-Linear Association	10.843	1	<.001

The above Table 2 chi-square and Table 3 one sample t-test proves the statistical

significance is present between e-Books and print books in terms of retention.

Table 4: Retention Comparison

	N	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic
Print Books	423	3.64	1.112	-.591	-.280
e-Books	423	3.39	1.121	-.310	-.546

The difference could be clearly proved based on Table 4, where print books have a

mean score of 3.64 opposed to e-Books having mean score of 3.39 which is lower than the average mean, whereas 7.4%

increase on retention is seen when reading from print books.

Exam Performance

This is an area which is undiscovered entirely in earlier researches with specific to this subject area and hence this would be a new value addition to the existing knowledge gap.

Table 5: Exam Performance t-Test

	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
EP4	58.544	422	<.001	<.001	3.243	3.13	3.35
EP5	71.904	422	<.001	<.001	3.645	3.55	3.75

Table 6: Exam Performance Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	103.429 ^a	16	<.001
Likelihood Ratio	107.925	16	<.001
Linear-by-Linear Association	2.118	1	.146

The statistical significance has been proved based on Table 5 and Table 6 statistical testing through one sample t-test and chi-

square test where the print books and e-Books are proved to be having statistically significant relationship in terms of exam performance.

Table 7: Exam Performance Comparison

	N Statistic	Mean Statistic	Std. Deviation Statistic	Kurtosis Statistic	Kurtosis Statistic
e-Books	423	3.24	1.139	-.131	-.746
Print Books	423	3.65	1.043	-.523	-.171

Table 7 explains the mean score for print books is 3.65 while e-Books stood at 3.24 which is lower than the average mean, while this proves undergraduate students utilizing print books show 12.7% higher exam performance and therefore print books becomes a superior choice for academic purposes.

Discussion

The findings clearly show the relationship and impact of retention and exam

performance whereas this research covers exam performance aspect when utilizing different modes of reading namely the e-Books and print books which was not studied in-depth earlier (Olivier et al., 2019). The impact on retention is significant among all age groups from school children till university undergraduates and even further as adults, where the retention of the subject reduced with time significantly (Mangen et al., 2013). The relationship between retention and exam performance would be 59.8%

positively affected therefore explaining that increase in retention will have significant improvement on the student's exam performance while the retention and its variance with exam performance could be attributed at 78.5% level.

The impact such reduction on retention will be affecting the students significantly who are from Asian countries where most of the university academic performance are assessed through examinations which rely heavily on the retention of text book content and being able to retain the pre-defined framework provided by lecturers (Entwistle, 1991; Wong, 2004). Though the impact on western countries should not be left behind as each and every university and curriculum will have a retention aspect inherent within their curriculum and it will be one of the primary assessment objectives though might differ slightly among disciplines (Scott et al., 2014), therefore the impact from reduced retention from e-Books is universal.

The comprehension and understanding factors are also affecting the exam performance while the print books are shown to provide higher comprehension abilities to students as well as the ability to understand the subject more clearly compared to studying from the e-Books (James, 2019; Mark et al., 2014). This is one of the elements studied from this paper which shows better and increased comprehension and understanding from print books is hereby proved through the findings from this paper.

Exam performance and retention being key elements of discussion based on the research questions raised to be studied under the hypothesis of this paper helps reach the conclusion and also the impact on the society due to the Coronavirus pandemic has been instrumental in such paradigm shift within the print books and e-Books reading modes due to unavoidable reasons present during the pandemic situation (Gamage et al., 2020; Samanta, 2020) but the accurate understanding of the impact on the students retention and exam

performance capabilities is important for best course of action and possible reversal of the paradigm shift based on the consequences and detrimental effects it imparts.

Conclusion

The exam performance of students would be higher among university undergraduates if they employed print books instead of e-Books for their academic reading purposes while the increase on exam performance could be attributed to the level of 12.7% compared with e-Book counterparts. The improvement of the student's retention capability will also be present when utilizing print books than e-Books while the increase could be attributed to the level of 7.4% higher on print books. This conclusion will lead to the understanding that print books would be the superior choice essentially at universities for undergraduate students and therefore introduction and imposing print book availability on libraries for academic purposes at least for university text books to be considered primary objective to alleviate long-term impact of reduced intellectuality and knowledge of the students and the society in line with United Nations Sustainable Development Goals (SDG) of achieving Quality Education.

Recommendation

Based on the findings and conclusion from this paper it is recommended to the university administration to promote the usage of print books instead of e-Books for academic reading purposes including but not limited to text books, while this could be promoted during classes, workshops and seminars among students where the benefits of utilizing print books needs to be clearly understood by the students.

The university academia could also consider utilization of print books on their own as well lobby and influence the library administration to make academic books and text books available in print format instead of e-Book version only and sufficient

availability of such books to cover all students' requirements to be met is recommended in order to leave no one behind, while this initiative could be supported with this research findings as evidence.

The impact on exam performance is to be well understood by the students as well as the academicians which would give an insight on the academic performance, while providing clear understanding where the impact on exam performance during COVID-19 which might cause students utilize e-Books more frequently have an impact on the academic performance of the students, which would be one of the contributory factors to lower grades.

Policy makers and regulators could consider introducing and promoting print books among the population while also directing public libraries and similar institutions to make print books readily available to the willing readers without transferring or promoting them with e-Book alternatives, where even this might provide cost savings in the short term the long term impact on the society and students in terms of reduced knowledge and intellectuality will be far greater and once that damage is done it might not be easy to restore and reverse.

Entrepreneurs and e-Book companies is provided with an opportunity to study the technical aspects and the reasons behind such reduced retention and exam performance and it is therefore recommended to entrepreneurs and e-Book companies to come up with innovative solutions which will overcome the issue with advanced e-Readers and e-Books which would be capable of providing higher retention and exam performance to students at least on par to print book standards.

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Appendix I

Question	Scale	Adapt/ Adopt/ Develop	Source
Construct – Demographics			
Age	Numerical	Adopted	(Frank et al., 2018)
Gender	Nominal	Adopted	(Yahya et al., 2012)
Province	Nominal	Adopted	(Sukati, 2018)
University Enrolled into	Nominal	Adapted	(Sukati, 2018)
My current study year is	Interval	Adopted	(Gilbert & Fister, 2015)
Construct – Learner's Profile			
Increasing age will decrease preference to e-Books	Ordinal (Likert)	Adopted	(Frank et al., 2018)
I used e-Books earlier	Ordinal (Likert)	Adopted	(Shelburne, 2009)
I believe with increasing undergraduate year I will use e-Books more	Ordinal (Likert)	Adopted	(Gilbert & Fister, 2015)

My Academic Performance is very good	Ordinal (Likert)	Adapted	(Pilcher et al., 2017)
Construct – Student Type			
I am interested in reading research papers and referencing	Ordinal (Likert)	Adapted	(Gilbert & Fister, 2015)
I refer to academically related content very much	Ordinal (Likert)	Adapted	(Gilbert & Fister, 2015)
I am enrolled as a full-time student	Ordinal (Likert)	Adopted	(Ahmed, 2018)
Research Level at your current level of Study	Ordinal (Likert)	Adapted	(Gilbert & Fister, 2015)
Construct – Eye Strain			
Letters on the screen become blurred when reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Eyes feel tired during or after reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Eyes hurt when reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Need to blink a lot while reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Need to strain your eyes to see well after spending time reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Feel your eyes cross when reading from e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
I have to blink because my eyes are dry, when I'm reading e-Books	Ordinal (Likert)	Adapted	(González-Pérez et al., 2014)
Construct – Preference to e-Books			
I prefer paper more than digital	Ordinal (Likert)	Adapted	(Kozlowski, 2012)
I purchased e-Books more than print books in the last 12 months	Ordinal (Likert)	Adopted	(Korwitts, 2015)
I prefer to read e-Books more than print books	Ordinal (Likert)	Adopted	(Korwitts, 2015)
I prefer using an e-Reader	Ordinal (Likert)	Adopted	(Korwitts, 2015)
I agree with the following statement: "E-Books will eventually become the most popular form of book in publishing"	Ordinal (Likert)	Adopted	(Korwitts, 2015)
People would buy print books if e-Books and printed books cost the same	Ordinal (Likert)	Adopted	("Printed Books vs. E-Books - Survey Report," 2015)
I always buy printed text books	Nominal	Adopted	(Kozlowski, 2012)
I prefer	Nominal	Adopted	(Kozlowski, 2012)
Number of books I have read in the last year	Ratio	Adopted	(Korwitts, 2015)
I own the e-Reader	Nominal	Adopted	(Korwitts, 2015)
Construct – Comprehension and Understanding			
I understand better when reading from printed books, when I read a story or other information	Ordinal (Likert)	Adapted	(Ezudein, 2017)

I use illustrations or titles to help me figure out what a story is about, this is more true when reading from a printed book	Ordinal (Likert)	Adapted	(Ezudein, 2017)
I comprehend easily what I read when reading from a printed book	Ordinal (Likert)	Adapted	(Palilonis & Butler, 2015)
I am able synthesize what I read easily when I read from a printed book	Ordinal (Likert)	Adapted	(Palilonis & Butler, 2015)
I am able to understand the author's purpose more clearly when I read from a printed book	Ordinal (Likert)	Adapted	(Palilonis & Butler, 2015)
I am able to understand the structure of the educational material more clearly when I read from a printed book	Ordinal (Likert)	Adapted	(Palilonis & Butler, 2015)
I am able to understand the author's stance more clearly when I read from a printed book	Ordinal (Likert)	Adapted	(Palilonis & Butler, 2015)
Construct – Retention			
I retain content better when reading a printed book than e-Books	Ordinal (Likert)	Adapted	(Gilewski & Zelinski, 1988)
When reading a novel or textbook, how often do you have trouble remembering what you have read from e-Books compared to printed books			
In the opening chapters, once you have finished the book.	Ordinal (Likert)	Adopted	(Gilewski & Zelinski, 1988)
Three or four chapters before the one you are currently reading.	Ordinal (Likert)	Adopted	(Gilewski & Zelinski, 1988)
The chapter before the one you are currently reading	Ordinal (Likert)	Adopted	(Gilewski & Zelinski, 1988)
The paragraph just before the one you are currently reading.	Ordinal (Likert)	Adopted	(Gilewski & Zelinski, 1988)
The sentence before the one you are currently reading.	Ordinal (Likert)	Adopted	(Gilewski & Zelinski, 1988)
I can retain significant much of information in single read when using printed books	Ordinal (Likert)	Developed	(Bartleby, 2021)
I can retain significant much of information in single read when using e-Books	Ordinal (Likert)	Developed	(Bartleby, 2021)
I have problems when remembering words or content read from e-Books than reading from printed books	Ordinal (Likert)	Adapted	(Troyer & Rich, 2017)
Construct – Repetition			
I feel the need to repeat the content again and again in order to retain them, when reading through e-Books than Printed Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
I have repeated the same text again due to unable to comprehend or retain in the first reading, when reading through e-Books than Printed Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)

I am confident on the ability to retain and absorb the content in one shot (one reading, without repetition), when reading through e-Books than Printed Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
I feel printed books need a smaller number of repetitions (or none at all) when reading compared with e-Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
I need significant repetitions when reading through e-Books to grasp the same content	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
I get full grasp of content in a single read, when reading through e-Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
I get full grasp of content in a single read, when reading through Printed Books	Ordinal (Likert)	Developed	(Bautista, 2020; Goh, 2010; Mehigan, 2020)
Construct – Exam Performance			
It is difficult to achieve the expected results when using e-books compared to printed books	Ordinal (Likert)	Adapted	(Barnum, 2011)
It is easy to prepare and perform in your examinations when studied using e-Books instead of printed books	Ordinal (Likert)	Adapted	(Barnum, 2011)
I am satisfied with achieving expected exam achievements when using e-books instead of printed books	Ordinal (Likert)	Adapted	(Barnum, 2011)
I will achieve higher exam results if I study through e-Books.	Ordinal (Likert)	Adopted	(Helzer & Dunning, 2012)
I will achieve higher exam results if I study through printed books.	Ordinal (Likert)	Adopted	(Helzer & Dunning, 2012)
Best performance was given when using printed books instead of e-Books at examination	Ordinal (Likert)	Adapted	(National Research Council, 2003)
Printed books help more with memorizing than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
Printed books help more with analysing than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
Printed books help more with synthesizing than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
My learning and performance increased when using printed books than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
My interest in the subject increased when using printed books than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
Printed books are a better instruction medium than e-Books	Ordinal (Likert)	Adapted	(National Research Council, 2003)
Construct – Effective Mode of Reading			
e-Books are easier than printed books for your survey and scanning needs of book reading	Ordinal (Likert)	Developed	(Kasmawati & Sakkir, 2020)

e-Books are easier than printed books for your questioning skills when reading a book	Ordinal (Likert)	Developed	(Kasmawati & Sakkir, 2020)
e-Books are easier than printed books for your reading needs of book reading	Ordinal (Likert)	Developed	(Kasmawati & Sakkir, 2020)
e-Books are easier than printed books for your recitation needs of book reading	Ordinal (Likert)	Developed	(Kasmawati & Sakkir, 2020)
e-Books are easier than printed books for your reviewal skills of book reading	Ordinal (Likert)	Developed	(Kasmawati & Sakkir, 2020)

Thank you for your participation & time.