Exam Performance And Retention Among E-Book Utilizing Undergraduates Of Sri Lanka

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Abstract

The undergraduate success is determined with exam performance pillared through retention, whereas mode of reading plays a vital role in signifying this relationship. Trends of adopting e-Books on rise quadrupled in the post COVID-19 world effecting impact among universities and libraries. Retention being key element on undergraduate studies of Asian countries while final outcome measured through Exam Performance achieved on semester and final examination. Sampling frame defined within Undergraduate student population with simple random sampling method, purely online based survey questionnaire data collection performed. Findings prove significant increase in Exam performance and Retention among students who utilized print books instead of e-Books as primary mode for reading. Concluding the fact prioritizing and promoting print book usage among universities and libraries will enhance improved results among undergraduates.

Introduction

The rise of E-Books started itself from its initial introduction to the market on 1971 (Bartram, 2014) supported by increased utilization of e-Book readers such as Kindle actively available in the market (Zickuhr et al., 2012) increased number of books readily available in electronic version (Connaway, 2003). Usage of electronic books decrease with age and users prefer larger screens (Myrberg, 2017). Customizable e-Books provide higher retention on Dyslexia readers (Thomson et al., 2013) but was not the case for normal individuals and students who saw significant retention drop in a weeks' time (Robinet et al., 2014), while some claim retention drop immediately after read (Olivier et al., 2019). This is a concern especially in Asian countries where exams are mostly retention based (Wong, 2004) and most academic questions could be answered from the framework and textbooks (Entwistle, 1991)

aggravating the impact of reduced retention from e-Books.

This paper paves the way of the study in Sri Lanka, an Asian country, the impacts of utilizing e-Books among university undergraduates and the impact it has ultimately on their exam performance in addition to retention, comprehension and understanding, learner's age, eye strain and effective mode of reading.

Review of Literature

Electronic books are favored by younger population and eye strain demotes its usage (Myrberg, 2017) and is effective for disabled population (Thomson et al., 2013). Retention and recalling found to be higher on print book readers than e-Book readers (Robinet et al., 2014) further affirmed recently where chronology and retention was lower on e-Books (Olivier et al., 2019). In addition to impact on retention, the comprehension and

understanding when reading from e-Books was lower than printed books (Mangen et al., 2013; Robinet et al., 2014) due to loss of personal touch (Crum, 2015) while requiring more repetitive reading for e-Book readers resulting in more time to grasp the same content (Szalavitz, 2012).

This impacts Asians more due to their undergraduate exams are retention based (Wong, 2004), where most examination questions are answerable from a pre-defined framework and academic textbooks (Entwistle, 1991).

Walberg's Theory of Educational Productivity explains relationship on mode of instruction and student's exam performance (IPL, 2022). The instruction medium could be print or e-Books when self-reading (Makatjane, 2017) which are known two instruction mediums (Embong et al., 2012), hence study into exam performance is limited (Olivier et al., 2019) and is explored through this paper.

Best knowledge retention practices is paramount at universities for better student academic achievement (Wamundila, 2011) through retention improvement (Hiebert, 2009) even though pathological retention degeneration is present at old age (Craik, 1973) majority of university undergraduates are aged less than 24 hence no impact of degeneration (Pellizzari, 2011) and is therefore relied on reading mode.

Scholarly libraries face paradigm shift from print books to e-Books (Chan et al., 2006), while e-Book readers are widely adopted among public library networks of developed nations (Wilkins et al., 2006) though 56.2% of students prefers printed books (Buzzetto-Hollywood & Elobaid, 2008). Eye strain causes health hazard when using e-Books (Rosenfield, 2016) triggering Computer Vision Syndrome (Benedetto et al., 2013) and causes motion sickness when travelling (Järvenpää & Häkkinen, 2012) common among Kindle users (Jeong, 2012).

Reading comprehension varies among mode of instruction (Reid, 2016) influence exam performance (Roush, 2018) based on importance, questioning, visualizing, inferring, and synthesizing strategies of comprehension (Cates-Darnell, 2002) but comprehension stated to be higher on print books and also tend to understand better (Tosun, 2014).

Retention is memorization and incorporation of knowledge while memorization is transferring from short term memory to long term memory and is associated with significantly higher exam performance (Golding et al., 2012) which is overlooked when shifting to e-Books from printed books, as most shift decision was based only on convenience factor (Wexelbaum et al., 2011) in turn affecting student's exam performance (Glass et al., 2013).

Repetition is based Conditioned response based on Ivon Pavlov under Classical conditioning theory (Clark, 2004) requiring repeated stimuli (Burns, 1980; Cherry, 2020) where repeated reading of the same content was required several times than print books (Kraft, 2012; Staff, 2013) hence extra time required to compensate for the requirement of repeated reading (Garland & Noyes, 2004) but time is rare asset of students (Amato et al., 2019).

Effective mode of reading is which can provide higher retention and exam performance to the students within a time effective nature helping improve intellectuality and overall knowledge of the students (Huang et al., 2017; Mangen et al., 2013) and therefore this paper studies on the effective reading mode being e-Book or the print book.

Still with such high penetration of e-Books, print books outsell e-Books by 10 times (Handley, 2019) even being in market for five decades and major companies such as Amazon investing into it (Spatz, 2018) and being convenient too search content, read many books at short period of time and skim read (Zhang, 2014) shows user preference is still for print books, poses a need to study this area.

Methodology

The research method is based on quantitative survey method research issued to university undergraduates of Sri Lanka based on proportionate simple random sampling covering all University Grants Commission (UGC) recognized universities.

"The patient is the one who knows the disease than the doctor" and based on it, the reader is the best person to comment on easy and effectiveness of that format of reading (Kennedy, 2003; Schneider et al, 2016). Therefore, perspective of students is considered as the basis of findings from the research.
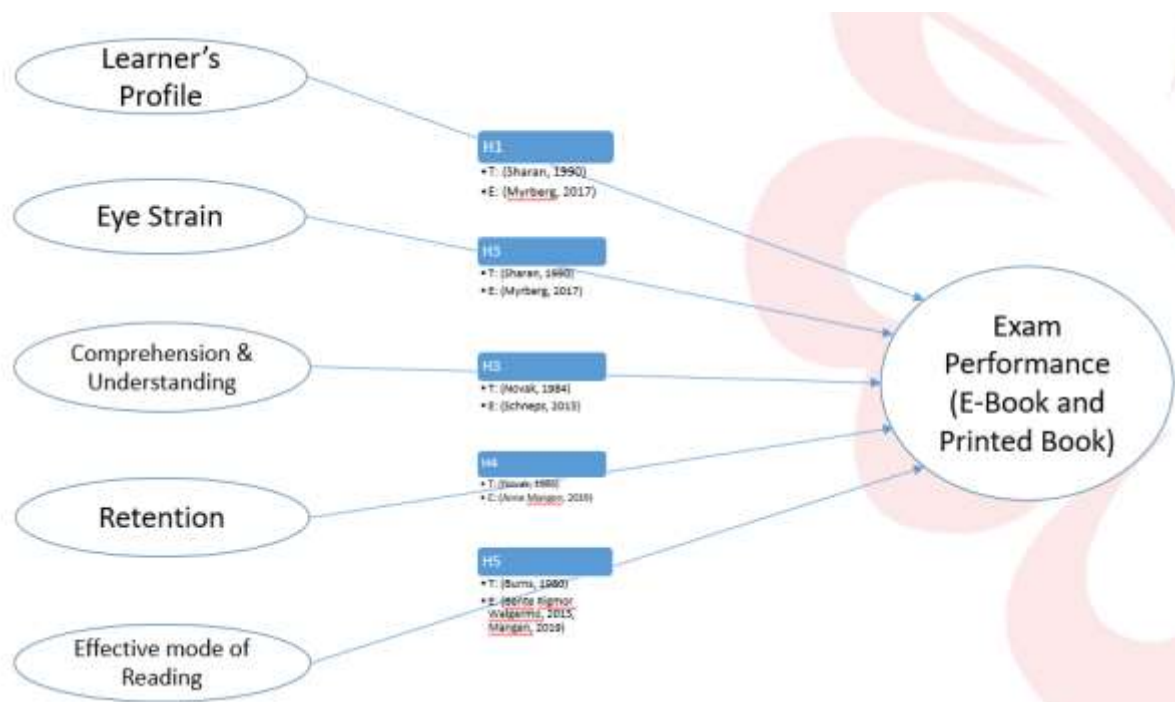

Figure 1 - Conceptual Framework

The methodology foundation was from the above Conceptual Framework which was supported both theoretically and empirically, to fill the knowledge gap of studies on understanding the impact of reading method on exam performance of the undergraduates.

Sampling and Data collection

Sampling frame was defined as Sri Lankan University Undergraduate Students and the sampling was performed by proportionately distributing those among the undergraduates of all universities of Sri Lanka using digital medium while appropriate buffer kept for response rate consideration. The response rate was 38% (Décieux, 2022) where 1,011 questionnaires were issued to achieve 384 responses (Krejcie & Morgan, 1970) to generalize 153,497 university undergraduates of Sri Lanka (UGC, 2022).

Instrument Development

The main constructs as described in the conceptual framework was adapted from existing questionnaires from literature for constructs Learner's Profile (Frank, 2017; Gilbert & Fister, 2015; Shelburne, 2009), Eye Strain (González-Pérez et al., 2014), Comprehension and Understanding (Ezudein, 2017; Palilonis & Butler, 2015), Retention (Gilewski & Zelinski, 1988), Effective Mode of Reading (Bautista, 2020; Goh, 2010; Mehigan, 2020), Exam Performance (Barnum, 2011; Helzer & Dunning, 2012).

The adopted questionnaire based on the above literature was subjected to expert review initially and following amendments from subject experts proceeded to pilot study among forty participants where reliability and validity was checked and amendments made before

establishing the final questionnaire. Post subject expert review and pilot study amendments the final amended questionnaire was issued to the target population of the sampling frame.

Method of Analysis

The analysis was mainly performed post cleaning of the data and screening and treating of missing data and inconsistent data among the collected data set which is analyzed through the IBM SPSS software and then through AMOS software for confirmatory path analysis.

The sample characteristics, descriptive statistics, exploratory factor analysis, Pearson's Chi-square, reliability and comparative means analysis performed at SPSS level while the model designing and confirmatory path analysis, modification indices, relationship

strength and r squared values studied from the AMOS application.

Findings

Sample Characteristics

The sample consisted of 58.9% males and 41.1% females which affirms the correct mixture of gender as females enrolled in tertiary education is lower (Statista, 2022; United Nations, 2021) while the age group distribution was perfect with higher number of students at age 22 which is the typical undergraduate age, 1st year students being higher declining with year explaining the dropout of students from undergraduate programs after the first year. Skewness and Ketosis within range affirming normal distribution of the sample (Lee et al., 2015; Muzaffar, 2016).

Reliability

Table 1 – Cronbach's Alpha Reliability Test

Construct	Pilot Reliability	Final Reliability
Eye Strain	0.860	0.840
Comprehension & understanding	0.853	0.813
Retention	0.788	0.709
Effective Mode of Reading	0.817	0.794
Exam Performance	0.808	0.833

KMO and Bartlett

Table 2 - KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.853
Bartlett's Test of Sphericity	Approx. Chi-Square	3935.618
	df	325
	Sig.	.000

The KMO above 0.7 (Di Leo & Sardanelli, 2020) and Bartlett Test Significance below 0.05 (Nijs, 2019) are within threshold hence proving statistical significance of the findings. The Total Variance Explained cumulative loading

was 60.276% which is above 60% threshold (Hooper, 2012) therefore the data explains the model and all items were loaded within respective constructs having loading values or

communalities above 0.6 where the threshold is
0.5 (Rehman, 2017) so acceptable.
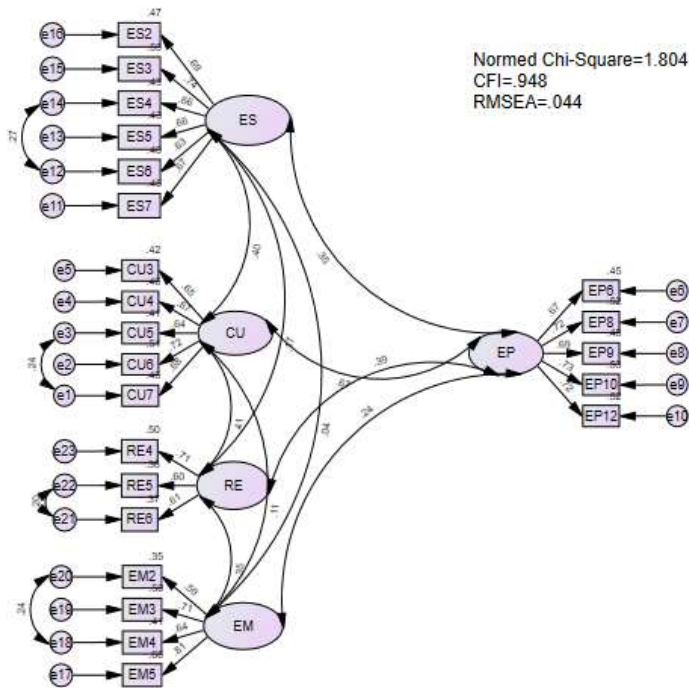
Confirmatory Factor Analysis

Figure 2 - Final Measurement Model

The above model explains the final measurement model derived from AMOS software.
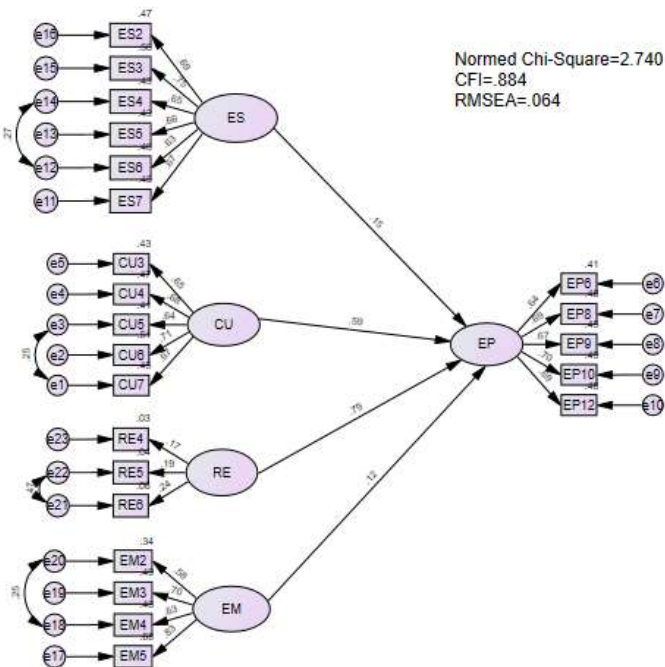

Figure 3 - Structural Model

The above structural model explains the structural relationship of the data with the model and confirms the pathway.

Table 3 - Model Modification

Variable	Initial Model			Modified Model			Comments
	Normed Chi-Square	CFI	RMSEA	Normed Chi-Square	CFI	RMSEA	
	<5.0	>0.9	<0.08	<5.0	>0.9	<0.08	
Overall Measurement Model	1.804	0.948	0.044	No modification required.			Initial Model itself is model fit.
Structural Model	2.740	0.884	0.064				

Modifications were not required as per the above table as the initial model fits itself of all the fit indices (Azam et al., 2021).

Hypotheses Testing

Table 4 - Hypotheses Testing

			Estimate	S.E.	C.R.	P	R^2
EP	<---	ES	.118	.040	2.980	.003	.153
EP	<---	CU	.526	.064	8.173	***	.588
EP	<---	RE	.598	.399	4.011	***	.785
EP	<---	EM	.084	.036	2.322	.020	.120

Comprehension and understanding construct with exam performance has a significant relationship with 0.526 estimated r value and 0.588 r-squared value showing positive moderate relationship therefore accepting the hypotheses, while retention and exam performance also being significant and having 0.598 r value and 0.785 r-squared value therefore hypotheses being accepted.

The hypotheses of relationship between exam performance and eye strain even though significant was estimated of having relationship at 0.118 and coefficient of 0.153 both explaining a very weak but positive relationship therefore rejected, whereas effective mode of reading and exam performance also having significant relationship but 0.084 positive relationship with coefficient of 0.120 is below threshold and hence rejected.

Findings

H(x)	Hypothesis	Significance	Relationship	Reference and Justification	Finding
H1	Eye strain is negatively related to Exam Performance	Significant	Very weak, Positive		Not supported

H2	Comprehension and Understanding is positively related to Exam Performance	Significant	Moderate, Positive	Table 4 - Hypotheses Testing	Supported
H3	Retention is positively related to Exam Performance	Significant	Strong, Positive		Supported
H4	Effective Mode of Reading is positively related to Exam Performance	Significant	Very weak, Positive		Not supported

Discussion

Based on the findings from this research the comprehension and understanding has positive strong impact with the exam performance of the students while the retention is also having positive and strong relationship with the exam performance therefore affirms the fact that the literature which supports Asian students are exam oriented and most exams are based on a framework and retention of text book content (Wong, 2004), this statement is still valid and up-to-date according to the findings from this research.

The higher ability of being able to comprehend and understand content on print books than on e-Books (Mangen et al., 2013), while also being able to retain better from print books compared with e-Books (Glass et al., 2013; Mangen et al., 2013), and proof from this research findings, altogether contribute to the findings that the exam performance of university undergraduates is linked to their comprehension and understanding as well as the retention of the content while there is significant advantage to retention and comprehension and understanding, ultimately to the exam performance when utilizing print books instead of e-Books.

Conclusion

It can be concluded from this review, the e-Books are seen to be irrelevant considering the toll it takes upon from students such as reduced retention power, need for more repetitions to grasp the same material resulting in wasting time, reduction in the comprehension and understanding attained from the read content and studying without much preference to the mode of reading.

The findings suggest that the eye strain is a negative factor found on e-Books which is adversely affecting the reading time of the students of books as well as their health and therefore the usage of e-Books should not be promoted without further conscious understanding of the issues and instead print books should be promoted.

Comprehension and Understanding and Retention are proved from this research as major contributors of the exam performance of undergraduate students and therefore the mode of reading which has higher comprehension and understanding capabilities as well as higher retention capabilities will positively cause a significant improvement on the academic performance of the undergraduate students.

Printed books are known to be having higher retention and comprehension and understanding capabilities based on previous studies as well as from this research and therefore this explains that using print books as the primary mode of reading for university textbooks and by university undergraduates will improve the overall exam performance of the students which will eventually help build better knowledge society and increase social intellectuality of the population.

Recommendation

Print books needs to be promoted at least for university undergraduates for their reading purposes of text books and for studying of university semester and final examinations which is proved to have higher ability of retention, comprehension and understanding for the students.

Libraries should not enforce e-Books among students and other academic members post-COVID and should study the impact thoroughly and should at least equally make print books available and let it to the reader's choice.

Practical examination and industry focused content should be given more weight than the earlier levels in university examinations as well to promote and create industry ready graduates as still according to the findings from this research it is seen that the exam performance purely relies on the retention of the content from text books.

The study into the impact on Exam performance could be a gap presented in this area which could be studied further and the geographical expansion of empirical studies are also recommended for better generalizability.

Future Researchers Scope

Research on the benefits of having few words per line and the benefits of e-Books supporting Dyslexia learners can be studied in great detail with the actual contributing factors be studied and further developed from Thomson et al. (2013)'s research.

Smartphone usage is declining with age (Myrberg, 2017), therefore further study on the factors causing such decline and retention and academic performance of students with age and reading through smart phone or usage hours of smart phone per day having such impact could be studied in detail.

Research by Robinet et al (2014) and Olivier et al. (2019) shows benefits of e-Books or at least similar performance except some factors, while such factors and the dependencies contributing

such can be further studied and also there is a significant impact of retention capabilities of readers which creates a knowledge gap which can be studied too.

Comprehension was much lower with e-Books (Mangen et al., 2013; Robinet et al., 2014) thus the retention aspect could be studied, and also the comprehension aspect in different settings and larger sample groups.

Repetition requirements in knowledge grasping through e-Books (Szalavitz, 2012) can be further studied in different settings for more context and improve validity of the statement.

Harman (2018) and Kouis (2014) discussed the benefits and potential transitional technical obstacles thus this could be studied further in-detail analysing the factors mediating or moderating the transition and also research into whether the benefits outweigh the loss can also be studied.

Rising e-Books in universities (Carlin, 2012) can be studied in different setting and among universities spread among different regional geographical locations.

Only 30% of students are satisfied with e-Books (Neyole, 2014) while this can be re-validated among different settings and at the same time analyse and find the major contributing factor for such preference change among students which will help e-Book companies modify their e-Books to improve user acceptance.

Limited number of Long – Term studies and Retention aspect specific studies (Frank, 2017) can be compensated with such studies in the research area while larger group of sample among general population without single destination specific is another solution for (Frank, 2017)'s statement on small group research, while a review article comprising of all such different location specific empirical studies will help create a fuller picture even without a larger population study. Studies of this nature which is usually academic therefore

this can fix the current problem of e-Book delivery company-based research bias and non-adherence to academic research standards.

Olivier et al. (2019)'s recommendation can be adopted by comparison of different presentation modes text by the way of experimenting.

User needs to scroll through the screen to read them (Rao, 2003) as opposed to no scrolling required when reading from a printed book

Negative comments were tiring, less efficient & even painful (Lam et al., 2009) which can be studied among different groups in geographically distant places to extend coverage and at the same time the reasons behind such issues and the method to improve e-Books by eliminating or at least reducing such side effects could be studied.

Most studies of e-Book Learner's Age and Preference being in US is justified in this article and therefore it can be further established or same research replicated in other geographic continents will improve the existing identified knowledge gap.

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