RETENTION AND EXAM PERFORMANCE BASED ON PRINT BOOK AND E-BOOK STUDY AT UNIVERSITIES IN SRI LANKA

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1. Introduction

Merkle notes that the rise of the e-book started from its initial introduction to the market in 1971 [1] supported by increased utilization of e-book readers, such as Kindle, actively available on the market [2], and an increased number of books readily available in electronic version [3]. Myrberg [4] declares that the usage of electronic books decreases with age, as well as users preferring larger screens. Customizable e-books provide higher retention for dyslexic readers [5] but was not the case for normal individuals and students who saw significant retention drop after only one week [6], while some claimed retention dropped immediately after reading [7]. Li [8] notes that this is a concern especially in Asian countries where exams are mostly retention based. Wood and Shirazi [9] say most academic questions can be answered using the framework and textbooks provided by lecturers, aggravating the impact of reduced retention from e-books because retention is paramount to achieving academic success and good marks depend on it.

Sri Lanka, a nation rich in cultural heritage, has an impressive historical and artistic tapestry that bears witness to its colorful past. In this study we analyze aspects of higher education as part of the cultural heritage of Sri Lanka, focusing on features in academia and technology The article provides a comprehensive approach to learning that integrates academic achievement with the depth of our historical and artistic narratives, highlighting the necessity of bringing our cultural legacy into the educational landscape [9].

Sri Lanka's cultural history has long included art in all of its manifestations. From exquisite traditional crafts to breathtaking architecture, students can draw inspiration from our artistic past. The next generation of artists, architects, and inventors can be fostered by universities through the inclusion of creative expression and art appreciation in the curriculum. In addition to preserving our legacy, encouraging students to follow their artistic interests develops creativity and ingenuity, two qualities that are highly valued in today's workforce [12].

It is crucial that we share our cultural heritage with the world community in this age of globalization. Universities can be key players in this effort by setting up joint research projects, exhibitions and cultural exchange programs. Through the exhibition of our cultural artifacts, traditional performances and historical artifacts, we can build a bridge of

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mutual respect and appreciation between cultures. Furthermore, publishing statistics and data about our cultural heritage in scholarly publications can become a significant way for supporting global policymakers and researchers by fostering a global conversation about the significance of cultural integration and preservation in higher education [13]. Including cultural heritage in higher education is a commitment to protecting our identity and creating a future that is firmly anchored in our past, not just a scholarly endeavor. Achieving a balance between technological advancements and cultural preservation is crucial as we navigate the digital age. Universities in Sri Lanka can produce well-rounded people who are not only academically adept but also culturally aware and appreciative by immersing students in the rich tapestry of our history and art. Assuring that our distinctive historical and artistic narratives continue to inspire future generations is made possible by empowering students to become ambassadors of our legacy through the integration of our cultural heritage into education. We can create a harmonious fusion of tradition and modernity by working together and being dedicated to cultural integration. This will enhance the educational experience and make the world a more culturally aware place [5].

This paper paves the way to studying the impact of utilizing e-books among university undergraduates in Sri Lanka, an island in South Asia, and the impact it ultimately has on their exam performance, in addition to other factors such as retention, comprehension and understanding, learner's age, eye strain and effective mode of reading.

2. Literature review

Electronic books are generally preferred by younger people. However, there is one big disadvantage to using e-books which is eye strain, a factor that can increase if e-book usage increases. This aspect consequently reduces the efficiency of e-learning for people with any eye impairments, making it difficult for them to positively benefit from their use, considering the many advantages of e-book features (e.g. easy navigating, etc.) [4, 5]. Retention and recalling are found to be higher in print book readers than e-book readers [6], further affirmed recently in a case where the time taken to remember and memory retention were lower with e-books [7]. In addition, the impact on retention, comprehension and understanding when reading from e-books was lower than printed books [10] due to the absence of touching and feeling the book materially and physically. More repetitive reading was also required on the part of e-book readers, as they needed more time to grasp the same content [11]. Li [8] notes that this impacts Asians more due to the fact that their undergraduate exams are retention based. So, according to Wood and Shirazi [9], most examination questions are answerable from a pre-defined framework and academic textbook.

Sri Lankan undergraduate students' academic experiences have been shaped by the introduction of innovative learning materials, especially e-books, through the convergence of technology and education in recent years. Exam performance and retention among e-book-using undergraduates in Sri Lanka is the subject of this study, which also examines a cognitive framework emphasizing the value of print book usage in academic institutions and libraries. It also tries to address the efficiency of the e-tools (books) used in bachelor learning, stressing the integration of cultural history and focusing on the distinct historical and artistic legacy that defines Sri Lanka, and analysing training and higher education, as one of modern Sri Lankan social values [11].

The cultural legacy of Sri Lanka includes a patchwork of varied influences, including interactions with its colonial past, indigenous customs, and ancient civilizations. As guardians of this legacy, our universities uphold and perpetuate the spirit of the past. A

mutually beneficial interaction is established between the academic realm and our historical roots when this cultural legacy is included and integrated into higher education. Students must be aware of their cultural identity in order to build a sense of pride and belonging as the future's torchbearers.

Universities can close the gap between the past and the present by including historical narratives in their curricula. Imparting important knowledge, studying the development of indigenous cultures, the rise and fall of ancient kingdoms and the effect of colonization fosters critical thinking and analytical abilities. Comprehending historical events within the framework of our nation cultivates empathy, motivating pupils to recognize the intricacies of historical accounts and their significance in contemporary globalized society [12-13].

In their research, Harris et al. [12] demonstrate that Walberg's Theory of Educational Productivity explains the relationship between the mode of instruction and student exam performance. Makatjane [13] and Tuah et al. [14] provided data showing that e-books can be a source for self-learning. However, there is not enough information about the efficiency of using e-books in learning or the efficiency of e-books when compared to print variants in learning new data or preparing for exams.

As Trivedi notes [15], the best knowledge retention practices are paramount at universities to achieve better student academic performance. It is through retention improvement [16] that results can be attained, even though pathological retention degeneration is present in old age, as Baddeley et al. [17] notes. But as the majority of university undergraduates are aged less than 24, no impact of degeneration or decrease in the ability to comprehend is due to aging. The majority of students rely on reading electronic, as well as print books, when learning and preparing for exams [18].

According to Zhang [19] scholarly libraries face a paradigm shift from print books to e-books, while Dawkins and Gavigan [20] declare e-book readers are widely adopted among public library networks in developed nations. Buzzetto-More et al. [21] reported that 56.2% of students in the University of Maryland Eastern Shore, United States of America, prefer printed books. Additionly, data by Alsadoon [22] says that eye strain causes health hazards when using e-books. From data given by Alsadoon [22] and Jyotsna and Amudha [23] it was found that there are triggers which can cause Computer Vision Syndrome and motion sickness when traveling, common issues among Kindle users. Furthermore, Park and Lee declare that reading comprehension varies according to the mode of instruction and influences exam performance based on the importance, questioning, visualizing, inferring and synthesizing strategies of comprehension [24]. Nevertheless, comprehension, as stated by Reich et al,. is higher in students who read print books [25]. Retention is memorization and incorporation of knowledge, while memorization is transferring from short-term to long-term memory and is associated with significantly higher exam performance, a point which is overlooked when shifting to e-books from printed books.

Most decisions to shift learning to e-tool usage are based on convenience factors without analyzing the efficiency of the student's exam performance [26]. Clark [27] declares that repetition is based on conditioned response that can be explained by Ivan Pavlov's theory of classical conditioning which requires repeated stimuli [27, 28]. Repeated reading of the same content was required several times more than for print books; hence, extra time was required to compensate for the necessity of repeated reading, but time is a rare asset for students [29].

An effective mode of reading is one which can provide higher retention and exam performance for students within a time-effective context to help improve the intellectuality and overall knowledge of students [30] Therefore, this paper studies effective reading modes as being either with an e-book or a print book.

3. Methodology

3.1. Study design and Sampling Frame

The presented research was based on the quantitative survey of university bachelor degree undergraduates (384 persons) of Sri Lanka, based on proportionate, simple random sampling covering all UGC (University Grants Commission) recognized government universities (a total of 17 universities). The online survey was sent to 1,011 participants from 153,497 Sri Lankan university undergraduates in total participating in all University courses. and was volunteer-based. Thus, as not all undergraduates completed the questionnaires, the final given response rate was 38%. The patient is the one who knows the disease better than the doctor'. Based on this statement, the reader is the best person to comment on the ease and effectiveness of the reading format, whether e-book or print books [31]. It is, therefore, the perspective of the students which is considered as the basis of the findings of the research. The methodology (conceptual framework) used is illustrated in Figure 1 and was supported both theoretically and empirically, in order to fill the knowledge gap regarding studies on understanding the impact of reading methods on undergraduate exam performance.

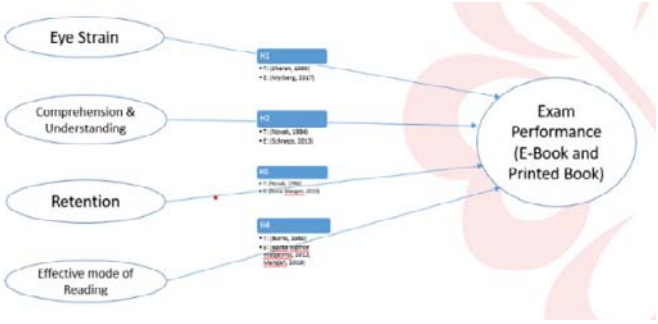

Figure 1. Conceptual framework.

3.2. Instrument development

The main constructs, as described in the conceptual framework, were adapted from existing questionnaires from literature and are as follows: Learner's Profile Eye Strain, Comprehension and Understanding, Retention, Effective Mode of Reading, Exam Performance [32-34]. The adopted questionnaire based on the above literature, which contained twenty-three equally weighted questions on a five-point Likert scale, was initially subjected to expert review. Following amendments from subject experts, we proceeded to pilot study among forty participants, where reliability and validity was checked, and further amendments were made before establishing the final questionnaire. The final amended questionnaire was then issued to the target population of the sampling frame.

3.3. Processing and analysis methods

The analysis was mainly performed after data cleaning, and screening and treating missing and/or inconsistent data in the collected data set which was analyzed through

IBM SPSS software and then through IBM SPSS AMOS software for confirmatory path analysis (Figures 2).

Blocks in Figure 2 are related to F1: Eye Strain (ES) F2: Comprehension and Understanding (CU) F3: Retention (RE) F4: Effective Mode of Reading variable (EM) F5: Exam Performance (EP). Sub-elements such as ES2-ES7 for block F1 are the questionnaire items loaded in the model, "e" blocks instead are the error terms for every single item resulting from the analysis [38, 39]. The following metrics were used with a threshold value for the model performance assessment. Normed Chi-Square: < 0.5 Comparative Fit Indices (CFI): > 0.9 Root Mean Square Error of Approximation (RMSEA): < 0.08. The structural model in Figure 2 explains the structural relationship of the data with the model and confirms the pathway. The calculations, as well as performance assessment, were made using IBM SPSS and IBM SPSS AMOS software [39].

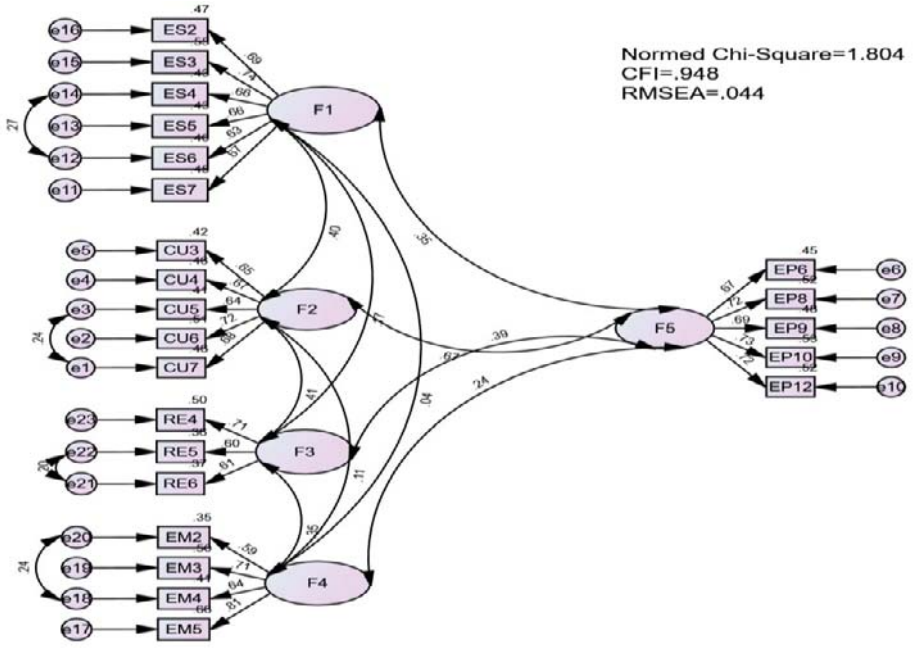

Figure 2. Final measurement model derived from IBM SPSS AMOS software. Keys: *F1: Eye Strain (ES)*, F2: Comprehension and Understanding (CU), F3: Retention (RE), F4: Effective Mode of Reading variable (EM), and F5: Exam Performance (EP).

3.3.1. Reliability

We assessed the study process at the Management and Science University using Cronbach's Alpha Reliability Test (CART), where a threshold above 0.7 is considered valid [38] and studied parameters such as eye strain in reading, comprehension and understanding and retention rate, as well as efficiency of the reading mode, and exam performance (Table 1).

3.3.2. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's test of Sphericity.

The Kaiser-Meyer-Olkin (KMO) test was used to examine the strength of the partial correlation where the TVE (Total Variance Explained) threshold is above 0.7 [38]: to test how the factors can explain each other between the variables.

And Bartlett's test of Sphericity was used for testing the null hypothesis [38]: is the correlation matrix present an identity matrix.So, we can see that the KMO was above 0.7 and the Bartlett Test Significance was below 0.05 and they were within the threshold (KMO above 0.7 and Bartlett Test below 0.05 [38]), hence proving the statistical significance of the findings (Table 2).

Table 1. Results according to 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

Table 2. Result of the conducted KMO test and Bartlett's Test.

KMO Test and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.853
Bartlett's Test of Sphericity	Approx. Chi-Square	3935.618
	df	325
	Sig.	0.000

The Total Variance Explained cumulative loading was 60.276% above the 60% threshold [38]. Therefore, all items loaded within respective constructs with loading values or commonalities above 0.6 and where the threshold is 0.5. So, they were assessed as acceptable. Confirmatory Factor Analysis was conducted according to the model described in Figures 2 and 3; the results are presented in Table 3.

Table 2. Model Modification

Tested parameters	Variable	
	Overall Measurement Model	***Structural Model***
Initial Model		
Normed Chi-Square (<5.0)	1.804	2.740
CFI (>0.9)	0.948	0.884
RMSEA (<0.08)	0.044	0.064
Modified Model		
Normed Chi-Square (<5.0)	No modification required	

CFI (>0.9)	
RMSEA (<0.08)	
Comments	The initial model is according to the modified model fit

So, it must be noted that the model which was included in the research needed no correction or modification because it was equivalent to the initial fitness indice values (presented in Figures 2 and 3) [36].

3.4. Hypotheses testing

Comprehension and understanding have significant relationships with exam performance, with an estimated r value of 0.526 and an r-squared value of 0.588 showing a positive moderate relationship. So in this way, if retention and exam performance are significant and have a 0.598 r value and 0.785 r-squared value therefore hypotheses being accepted (Table 4). Table 4 explains the relationships between Exam Performance (EP) and Eye Strain (ES), Exam Performance (EP) and Comprehension and Understanding (CU), Exam Performance (EP) and Retention (RE) and Exam Performance (EP) and Effective Mode of Reading (EM) and their Correlation Estimate, Standardized Estimate (S.E), Composite Reliability (C.R.), P-value of each relationship (P) and Correlation squared value (R^2).

Table 3. Hypotheses Testing Results

			Estimate	**S.E.**	**C.R.**	**P**	**R^2**
EP	<---	*ES*	0.118	0.040	2.980	0.003	0.153
EP	<---	*CU*	0.526	0.064	8.173	***	0.588
EP	<---	*RE*	0.598	0.399	4.011	***	0.785
EP	<---	*EM*	0.084	0.036	2.322	0.020	0.120

The relationship between exam performance and eye strain was significant. However, it was weak and positive (of 0.118 and a coefficient of 0.153). It was consequently rejected for this study. The efficiency of the reading mode and exam performance also demonstrated a positive relationship at 0.084 and a coefficient of 0.120 but it was lower than the acceptance threshold; for this reason, it was also rejected.

3.5. Findings

Table 5 presents the study results based on the data of Table 4: a p-value below 0.05 is considered significant, a correlation value r below 0.2 is weak, 0.5 is moderate, and above 0.7 is significant. If a hypothesis is considered "significant" and the relative "relationship" is moderate or strong while the direction remains valid (positive or negative relation) then the study finding is supported.

4. Discussion

Still, with such a high penetration of e-books, print books outsell e-books by 10

times, as Handley [37] notes. Writer, marketer and President Emeritus of Book Baby, the nation's leading self-publishing company Steven Spatz [38] gives data in his blog that even after being in the market for five decades and with major companies such as Amazon investing in printed books, they have not yet assessed the impact on exam performance.

Table 5. The indicated results of the conducted study

H(x)	Hypothesis	Significance	Relationship	Reference and Justification	Finding
H1	Eye strain is negatively related to Exam Performance	Significant	Very weak, Positive	Table 3. Hypotheses Testing	Not supported
H2	Comprehension and Understanding is positively related to Exam Performance	Significant	Moderate, Positive		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

Moreover, Zhang [19] notes that users still prefer print books, especially for short time reading (for pleasure), posing a need to study this area further.

The findings from this research affirm the fact that the literature which supports Asian students are exam oriented and that most exams are based on a framework and retention of textbook content.

Mangen et al. [10] note that print books give a higher ability to be able to comprehend and understand content through increased retention than e-books. Also, as Mangen et al. [10] and Glass et el. [26] note, the use of print books allows for better data retention compared with e-books; the findings from this research contribute to other findings that show the exam performance of university undergraduates is linked to their comprehension and understanding as well as to retention of the content. There is a significant advantage to comprehension, as it ultimately improves students' performance in the exam through increased retention, which is achieved by utilizing print books instead of e-books.

5. Conclusions

Thus, e-Books are considered irrelevant considering the toll they take on students, such as reduced power of retention and the need for constant repetition to grasp the

same material. The findings suggest that eye strain is a negative factor, found when using e-books, which adversely affects the reading time of the students of books, as well as their health. Therefore, the usage of e-books should not be promoted without further conscious understanding of the issues; instead, print books should be promoted. This research has shown that comprehension, understanding and retention are major contributors in the exam performance of undergraduate students, therefore, a mode of reading that produces higher comprehension and understanding capabilities, as well as higher retention capabilities, will positively impact the academic performance of undergraduate students so they achieve significantly better results. Based on previous studies, as well as from this research, printed books are known to have higher retention, comprehension and understanding capabilities. Therefore, using print books as the primary mode of reading for university textbooks by university undergraduates will improve their overall exam performance and will eventually help build a better knowledge society, as well as increase the social intellectuality of the population.

6. Practical recommendations

In conclusion, print books need to be promoted, at least for university undergraduates who regularly use academic textbooks for reading and study purposes during each semester and final examinations, as they have proved to give students a higher ability to retain, comprehend and understand subject matter when they are used.

Libraries should not enforce e-books among students and other academic members. The impact of using e-books for study purposes should be studied thoroughly and, however, print books should be made equally available and ultimately leave the choice to the reader, who ultimately should decide which is best for them.

7. Future research scope

Based on the scope of the research findings, print books currently provide students with better retention and exam performance capabilities than e-books. Therefore, a method of achieving the same results using e-books needs to be found and studied in the future.

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Summary

The mode of reading plays a vital role in signifying the relationship between reading (getting the information) and remembering, which, in the end, transforms into professional skills formation. We looked at the assessment of the study's success in using different sources of the specialty study information (print and e-Books). The research was based on the analysis of students' exam success in their bachelor's degree. The sampling frame was defined within the undergraduate student population with a simple random sampling method. An online-based survey questionnaire was performed and the data collected and examined. The findings showed a significantly higher level of success in exam performance and retention among students who utilized print books instead of e-Books as a primary mode of reading. It was noted that eye strain becomes a negative factor in using e-Books and adversely affects the reading time of the students. The usage of e-Books should not be promoted without a further conscious understanding of their pros and cons. We present a local assessment of the efficacy of using e-books in the higher education process by analysing student exam performance in Sri Lanka when using print books and e-books. It was concluded that prioritizing and promoting print book usage among universities and libraries improved academic results among undergraduates and that print book usage shows students are better able to comprehend data when compared to e-book usage.

Riassunto

La modalità di lettura gioca un ruolo fondamentale nel significare il rapporto tra leggere (ottenere informazioni) e ricordare, che si trasforma in formazione di competenze professionali. Abbiamo esaminato la valutazione del successo dello studio nell'utilizzo di diverse fonti di informazioni sullo studio specialistico (stampa ed e-book). La ricerca si è basata sull'analisi del successo degli esami degli studenti della laurea triennale e sul modo in cui hanno ottenuto le informazioni. Il quadro di campionamento è stato definito all'interno della popolazione studentesca universitaria con un semplice metodo di campionamento casuale. È stata eseguita la raccolta dei dati del questionario del sondaggio online. I risultati dimostrano un aumento significativo delle prestazioni agli esami e della fidelizzazione tra gli studenti che utilizzavano libri cartacei anziché e-book come modalità principale di lettura e, di conseguenza, come modalità principale di competenze professionali. Possiamo notare che l'affaticamento degli occhi diventa un fattore negativo riscontrato negli e-book. Sta influenzando negativamente il tempo di lettura degli studenti. L'uso degli e-Book non dovrebbe essere promosso senza un'ulteriore comprensione consapevole dei loro pro e contro. Vogliamo presentare la valutazione locale dell'efficienza dell'uso degli e-Book nel processo di istruzione superiore prendendo l'esperienza della regione asiatica (nello Sri Lanka). Possiamo quindi concludere che dare priorità e promuovere l'uso dei libri stampati tra le università e le biblioteche migliorerà i risultati tra gli studenti universitari. L'utilizzo dei libri stampati mostra una maggiore capacità di comprensione dei dati da parte degli studenti e la loro comprensione rispetto agli e-Book.