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Transactional Patterns of Academic E-Book Usage: The Case of Ebook Library

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Abstract

This paper describes the transactional patterns of Ebook Library (EBL), one of the aggregator platforms owned by ProQuest, e-book titles at the Edith Cowan University (ECU), Western Australia to know the way and extent of usage. This study is longitudinal, involving three years' worth of EBL usage data, investigating information seeking behavior by scholarly users of e-books employing statistical log analysis of the metadata datasets (logs) that describe e-book use.

This study compares three years' transaction logs for EBL e-book titles used by the ECU community. The metrics used include aggregate trends, views, minutes spent, titles used, users, academic calendar, sessions, searches, and item type. This paper may be useful for librarians to make evidence-based informed decisions while selecting the e-book acquisition model of aggregator/supplier platforms. The e-book researchers may also find this paper useful to explore further metrics of e-book user behavior.

Keywords: E-book usage; Academic libraries; Ebook Library; Edith Cowan University; Australia; Transaction analysis; Evidence-based librarianship.

Introduction

Ebook Library (EBL) is a private, commercial e-book aggregator/supplier owned by ProQuest on May 13, 2013 (EBL, 2013a). EBL acquires and aggregates e-books from leading publishers worldwide in a variety of disciplines and offer them on a single platform for use either online via their own interface or offline via Adobe Digital Editions. Main EBL customers include academic, corporate and research libraries. EBL also allows limited copy/paste, print, and download options. An EBL e-book can be printed (up to 20%) and copied (five per cent) in online-read mode following digital rights management (DRM). An e-book can also be downloaded to a PC, laptop, and most mobile e-reader devices, which automatically expires after one (mostly new books) to seven (mostly old books) days.

The MARC records supplied by EBL do not usually have an edition statement. EBL records the year of publication when the e-book was digitised, not when initially published in print format even if the same edition was digitised. A downloaded e-book can also be copied or printed as per stated limits. An online e-book can also be experienced as audio, an accessibility feature. There are two main types of acquisition models for libraries, subject packages or title by title rental/purchase, and pay-per-use/view. Concurrent users may be fixed or unlimited. The Edith Cowan University (ECU) Library, Perth, Australia, purchased access to the full EBL database as per a pay-per-use model with unlimited concurrent users with effect from January 1, 2010. The ECU EBL e-book collection held nearly 350,000 titles in October 2013 (EBL, 2013b).

Purpose of the Study

This paper describes the transactional patterns of Ebook Library (EBL), one of the aggregator platforms, e-book titles at the Edith Cowan University (ECU), Western Australia to know the way and extent of usage.

Target Datasets, Methodology and Tools

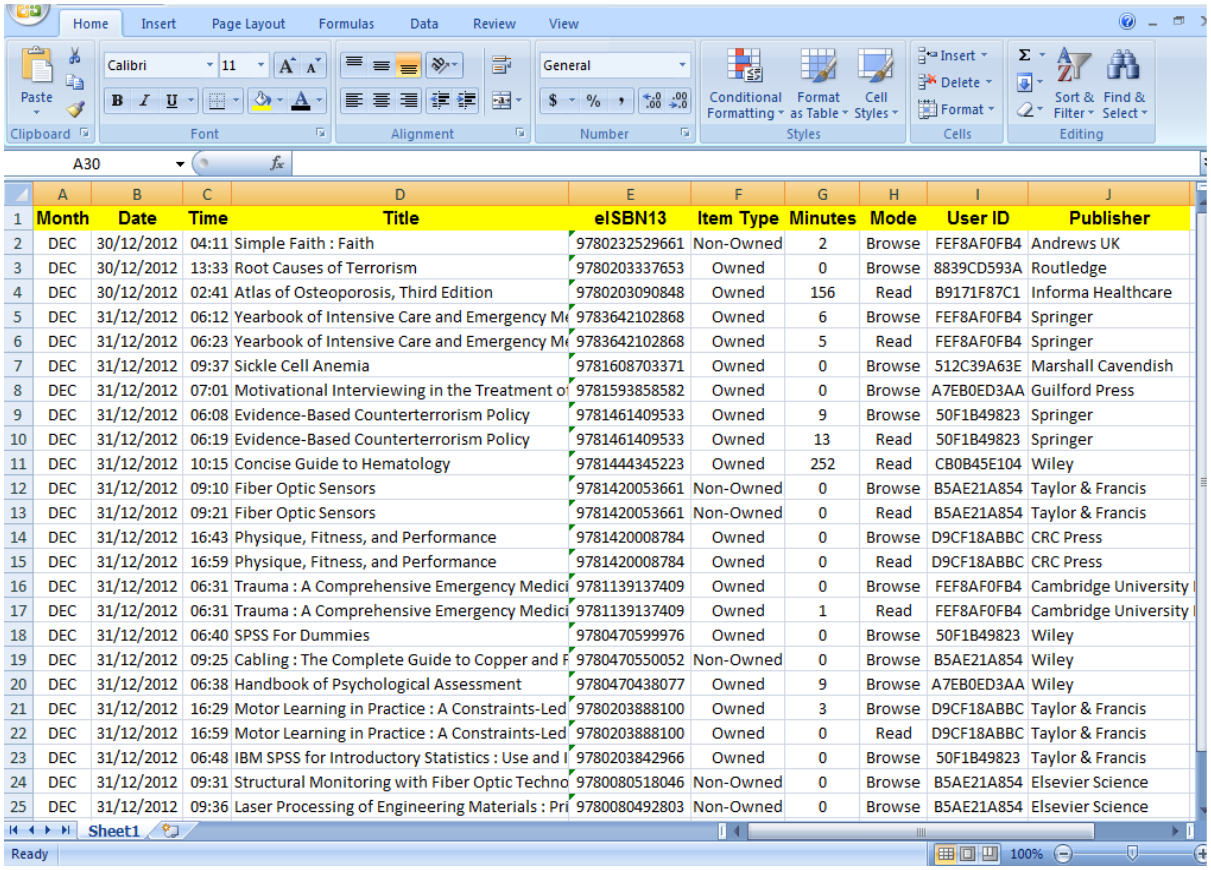
This study is longitudinal, involving three years' worth of EBL usage data, investigating information seeking behavior by scholarly users of e-books employing statistical log analysis of the metadata datasets (logs) that describe e-book use. This paper compares three years (2010, 2011, and 2012) transaction logs for EBL e-book titles used by the ECU community.

EBL generates different types of reports as transaction logs of e-book usage in spreadsheet (Excel) format. EBL records every e-book transaction as and when it happens in two different modes – *Browsing* and *Reading* – with the same variables. The difference between browsing and reading modes is that browsing is a free-of-charge trial for the first five minutes for non-owned e-books (McLure & Hoseth, 2012) and ten minutes for owned e-books (D. Howard, personal communication, April 13, 2011) and reading (paid use) begins automatically thereafter. For owned e-books, additional charging after ten minutes is a platform fee for service. These fees are less for owned e-books than for books that are not owned. McLure and Hoseth further explain that "Beyond browsing use includes short-term loans of unowned titles, and non-linear loan days and downloads of owned titles" (p. 140). Wells and Dumbell (2010) explain that the browse mode only occurs when a user first time accesses an EBL e-book. After certain minutes in browsing mode, the usage switches automatically to a read-online mode. All subsequent usage will occur in reading mode whenever the same user accesses the same e-book, especially in the case of non-owned e-books. Print, copy, and download provisions are available in reading mode only.

The study variables include Month of usage, Usage date, Time of usage, Title of e-book, standard number (eISBN13), owned or non-owned status of an e-book (Item Type), Minutes of usage, browsing or reading (Mode), particular User ID (encrypted and anonymised by EBL), and Publisher. Two variables, Month (derived from usage date) and Mode, were added by the researcher. One variable, Day (derived from usage date), was added later by the researcher. The Mode variable was added to distinguish browsing and reading transactions when both were combined.

The data were first cleaned and made usable. In the preliminary analysis, data were imported into MS Access where SQL queries were used to mine the datasets. MS Excel and SPSS were also used for analyses. Figure 1 presents a user view of an EBL transaction log file in Excel. Besides column headings, each row contains one record or transaction or view or use instance. Hence, the number of transactions/views/records/use instances means the number of rows.

Assumptions testing. The assumption that variables are normally distributed may be tested employing various standard numeric and graphic procedures (Allen & Bennett, 2010). Four tests including a Kolmogorov-Smirnov (K-S) test were performed to check for normality of the three-year individual and combined dataset(s). All the numeric or numerically quantifiable/transformable variables, especially Minutes and Views, were found to be non-normally distributed, a phenomenon also seen from Skewness and Kurtosis in the descriptive statistics. These normality test results suggest the use of non-parametric procedures for inferential statistics (Allen & Bennett).



Month	Date	Time	Title	eISBN13	Item Type	Minutes	Mode	User ID	Publisher
DEC	30/12/2012	04:11	Simple Faith : Faith	9780232529661	Non-Owned	2	Browse	FEF8AF0FB4	Andrews UK
DEC	30/12/2012	13:33	Root Causes of Terrorism	9780203337653	Owned	0	Browse	8839CD593A	Routledge
DEC	30/12/2012	02:41	Atlas of Osteoporosis, Third Edition	9780203090848	Owned	156	Read	B9171F87C1	Informa Healthcare
DEC	31/12/2012	06:12	Yearbook of Intensive Care and Emergency M	9783642102868	Owned	6	Browse	FEF8AF0FB4	Springer
DEC	31/12/2012	06:23	Yearbook of Intensive Care and Emergency M	9783642102868	Owned	5	Read	FEF8AF0FB4	Springer
DEC	31/12/2012	09:37	Sickle Cell Anemia	9781608703371	Owned	0	Browse	512C39A63E	Marshall Cavendish
DEC	31/12/2012	07:01	Motivational Interviewing in the Treatment o	9781593858582	Owned	0	Browse	A7EB0ED3AA	Guilford Press
DEC	31/12/2012	06:08	Evidence-Based Counterterrorism Policy	9781461409533	Owned	9	Browse	50F1B49823	Springer
DEC	31/12/2012	06:19	Evidence-Based Counterterrorism Policy	9781461409533	Owned	13	Read	50F1B49823	Springer
DEC	31/12/2012	10:15	Concise Guide to Hematology	9781444345223	Owned	252	Read	CB0B45E104	Wiley
DEC	31/12/2012	09:10	Fiber Optic Sensors	9781420053661	Non-Owned	0	Browse	B5AE21A854	Taylor & Francis
DEC	31/12/2012	09:21	Fiber Optic Sensors	9781420053661	Non-Owned	0	Read	B5AE21A854	Taylor & Francis
DEC	31/12/2012	16:43	Physique, Fitness, and Performance	9781420008784	Owned	0	Browse	D9CF18ABBC	CRC Press
DEC	31/12/2012	16:59	Physique, Fitness, and Performance	9781420008784	Owned	0	Read	D9CF18ABBC	CRC Press
DEC	31/12/2012	06:31	Trauma : A Comprehensive Emergency Medici	9781139137409	Owned	0	Browse	FEF8AF0FB4	Cambridge University
DEC	31/12/2012	06:31	Trauma : A Comprehensive Emergency Medici	9781139137409	Owned	1	Read	FEF8AF0FB4	Cambridge University
DEC	31/12/2012	06:40	SPSS For Dummies	9780470599976	Owned	0	Browse	50F1B49823	Wiley
DEC	31/12/2012	09:25	Cabling : The Complete Guide to Copper and F	9780470550052	Non-Owned	0	Browse	B5AE21A854	Wiley
DEC	31/12/2012	06:38	Handbook of Psychological Assessment	9780470438077	Owned	9	Browse	A7EB0ED3AA	Wiley
DEC	31/12/2012	16:29	Motor Learning in Practice : A Constraints-Led	9780203888100	Owned	3	Browse	D9CF18ABBC	Taylor & Francis
DEC	31/12/2012	16:59	Motor Learning in Practice : A Constraints-Led	9780203888100	Owned	0	Read	D9CF18ABBC	Taylor & Francis
DEC	31/12/2012	06:48	IBM SPSS for Introductory Statistics : Use and I	9780203842966	Owned	0	Browse	50F1B49823	Taylor & Francis
DEC	31/12/2012	09:31	Structural Monitoring with Fiber Optic Techno	9780080518046	Non-Owned	0	Browse	B5AE21A854	Elsevier Science
DEC	31/12/2012	09:36	Laser Processing of Engineering Materials : Pri	9780080492803	Non-Owned	0	Browse	B5AE21A854	Elsevier Science

Figure 1. A user view of EBL e-book transaction log file (MS Excel)

Findings of the Study

This section describes the findings of this study against the log metrics used.

Patterns of use: Aggregate trends. EBL e-book usage grew between 2010 and 2012 across all the variables except Total Minutes, Minutes in reading, and MinMax as shown in Table 1.

Table 1. Aggregate Trends in EBL Use

Variable	# 2010	# 2011	# 2012	Row Total
ECU population*	25,943	25,734	25,404	77,081
EBL Collection (Titles)*	145,000	190,000	212,973	547,973
Total unique users who browsed*	8,482	9,353	11,690	29,525
Unique users who read from among browsing users*	5,347	5,962	8,303	19,612
Total unique titles browsed*	13,796	14,266	17,976	46,038
Unique titles read from among browsed titles*	7,308	7,891	10,026	25,225
Total transactions / Views	65,190	70,750	97,273	233,213
Browsing transactions / Views	46,206	48,939	66,911	162,056
Reading transactions / Views	18,984	21,811	30,362	71,157
Total Minutes (browsing and reading)	1,364,275	2,186,797	1,272,647	4,823,719

Minutes in browsing	99,543	118,841	160,352	378,736
Minutes in reading	1,264,732	2,067,956	1,112,295	4,444,983
Highest/maximum Minutes (MinMax) spent on reading one title by one user in one session	1,439	2,884	1,332	5,655
Searches run**	6,241	19,419	25,472	51,132
Sessions**	52,050	56,821	70,286	179,157

* Year-wise unique; ** Searches and sessions figures were calculated by EBL. All other figures were calculated by the researcher except ECU population and EBL collection (titles).

ECU e-book user population. Between 2010 and 2012 ECU's population in terms of cohorts adopted for this study is shown in Figure 2 (Edith Cowan University, 2013). The ECU EBL e-book user-base 2010-2012 as a proportion of the ECU population grew annually from 8,482 (N = 25,943; 32.69%) in 2010, to 9,353 (N = 25,734; 36.34%) in 2011, to 11,690 (N = 25,404; 40.02%) in 2012 of year-wise unique users. Figure 2 shows the proportion of e-book users in ECU's population.

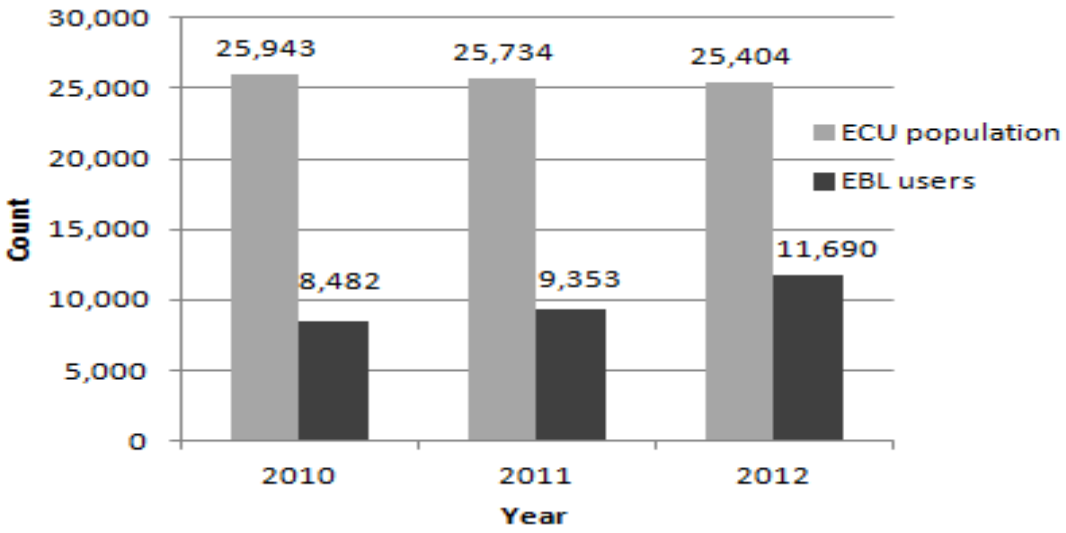


Figure 2. ECU population and EBL users

On average approximately 38.30% of the ECU population made use of EBL e-books between 2010 and 2012. In other words, on average, approximately 61.70% of the ECU community never used any EBL e-book in three years. The repeating (duplicate/triplicate) users were 3,172 (2010-11), 2,270 (2010-12), 3,951 (2011-12), and 7,862 (2010-11-12).

User transactions/views. Transactions are recorded in two modes of use, browsing and reading. As discussed, browsing is free of cost trial use for the first five minutes (10 minutes for owned e-books) and reading (paid use in accordance pay-per-use/view model) starts automatically thereafter. ECU pays per minute (multiple of one with round down) for all those titles used in either direct (online) or indirect (downloaded/offline) reading modes. Based on combined data of three years (N=233,213) browsing transactions (69.49%) are more than twice those of reading ones (30.51%) indicating that titles browsed are not necessarily read. Each transaction forms one record of a particular title viewed by a particular

user on a particular date spending particular minutes either in browsing or reading. Hence, a full-year usage report may consist of many repeated transactions of the same titles and users on different dates and times.

EBL transactions/views increased 8.53% (2010-11), 37.49% (2011-12), and 49.21% (2010-12) with a respective increase of 5,560, 26,523 and 32,083 views. A review of the frequency distribution shows that consistently across the reported years around one-third of all transactions were abandoned in less than one minute and more than one-half in less than three minutes (calculation based on multiples of one minute with round down.). Without data on query efficiency, definitive interpretation of this analysis outcome is not possible. So what else can be said of the behavior of users? Figure 3 shows the number of ECU e-book users in browsing and reading modes. Reading users are not separate but are from among browsing users, for example, 100 people started a race (browsing users) but 50 of them reached the destination (reading users). The same example applies to browsed and read titles as well. On average, 66.42% of the browsing users entered the reading mode at least once.

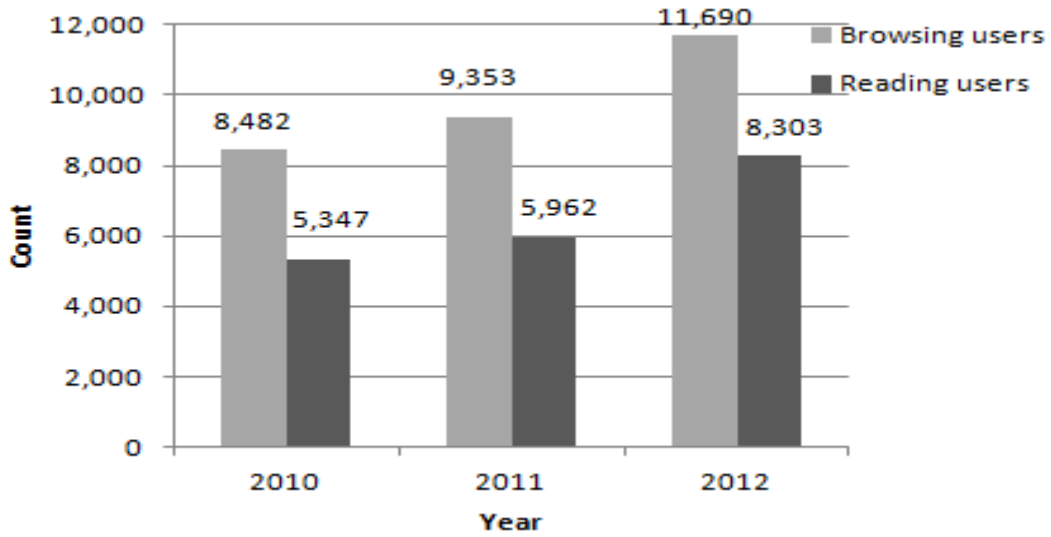


Figure 3. ECU e-book users in browsing and reading

A Kruskal-Wallis one-way ANOVA indicated a statistically significant difference (at $\alpha = 0.05$) in the year-wise distribution of user views/transactions with a small effect size (Table 2).

Table 2. Distribution of Transactions/Views: ANOVA (N=29,525; df=2)

Year	**2010**	**2011**	**2012**
Mean rank	14,275.47	14,319.47	15,471.60
H (adjusted for ties)	136.494		
p	.000		
Effect size η2	.005, small (Allen & Bennett, 2010)		

Further posthoc tests filtered the groups by indicating the statistically significant differences between 2010-2012, and 2011-2012, whereas there was no significant difference for 2010-2011. A substantial increase in transactions by 44.81% and 36.72% (browsing), and 59.93% and 39.20% (reading) was recorded respectively between 2010-2012 and 2011-2012. The analysis is consistent with EBL's debut as a relatively new service in 2010-2011 and growing user engagement in 2012. Although, there has been an increase in both the browsing

and reading transactions aligned with growth in user-base, the ratio between browsing and readings was consistent across the three years at approximately 70:30.

User minutes spent on EBL e-book use. The variable "Minutes" accounts for the minutes spent by users in browsing and reading e-books encompassing every instance/case (N=233,213). On average annually a user spent overall 163.38 minutes (12.83 in browsing, 150.55 in reading), 20.68 minutes per transaction/view (1.62 in browsing, 19.06 in reading) in each of the three years, 2010-2012. These average data are affected by outliers. More appropriate interpretation involves the constructs of median, mode, skew and kurtosis. Year-wise descriptive statistics of minutes are shown in Table 3.

Table 3. Descriptive Statistics of User Minutes

Statistic	Year 2010	Year 2011	Year 2012
Median	2	2	2
Mode	0	0	0
Skewness	9.150	7.390	7.171
Kurtosis	97.699	62.651	80.455
Max	1,439	2,884	1,332

Extreme variability is evident from the skewness and kurtosis values that describe lop-sided, lower values dominated distribution. The median (2 minutes) and mode (0-minute) are unchanged across three years. Although the transactions of minutes increased every year the sum of Minutes decreased in 2012 with the introduction of offline use of e-books via downloading or printouts. However, the interquartile range is five minutes in 2010 and six minutes each in 2011 and 2012. Mode, median and skewness values show that most users only browse. The distribution also indicates some extraordinary or outlier instances on the consumption of minutes, e.g. so-called 'power user.' Table 4 shows this variability.

Table 4. Frequency of User Minutes Consumed at EBL

	Year 2010		Year 2011		Year 2012	
Transactions	Frequency	%	Frequency	%	Frequency	%
0-minute	21,363	32.8	20,369	28.8	30,500	31.4
1-minute	9,207	14.1	9,867	13.9	12,873	13.2
2-minute	6,053	9.3	6,723	9.5	8,707	9.0
3-minute	4,953	7.6	5,438	7.7	7,197	7.4
4-minute	6,450	9.9	6,715	9.5	8,473	8.7
5-minute	1,965	3.0	2,261	3.2	3,107	3.2
6-minute	1,370	2.1	1,698	2.4	2,410	2.5
7-minute	1,244	1.9	1,605	2.3	2,302	2.4
8-minute	1,360	2.1	1,781	2.5	2,543	2.6
9-minute	2,170	3.3	2,935	4.1	4,127	4.2
=>10-minute	9,055	13.9	11,358	16.1	15,034	15.4
Total	**65,190**	**100**	**70,750**	**100**	**97,273**	**100**

Maximum minutes spent (MinMax). The variable 'Minutes Max' is the highest/maximum minutes spent by a user in viewing a title measured across a single transaction. Data in 2010 and 2011 are unreliable as a measure of extended reading with a

single title since a machine may be inactive with a title running. Parameterisation includes a maximum of five minutes for un-owned and 10 minutes for owned e-books in browsing mode. A downloaded e-book for offline use with Adobe Digital Editions (software introduced in 2012) expires after one to seven days. No data are contained in EBL transaction logs describing this kind of use. From 2012, a loan for titles in online reading mode expired after 24 hours, a measure taken to control inactivity. This explains the decrease in Minutes Max in 2012, compared with the previous two years.

E-book titles used. Since EBL keeps on adding new titles to its database every month, mid-year figures of EBL title availability were obtained from EBL blog posts in 2010 and 2011 (Lily, 2010, 2011) and directly from the EBL website for 2012 <www.ecu.eblib.com.au> on 18th July 2012, to provide a more reliable estimate of unique EBL titles used, compared with ECU population including new student enrolments of both the semesters in a year.

The number of unique EBL titles used at ECU increased 3.41%, 26.01%, and 30.30% (browsed) and 7.98%, 27.06%, and 37.19% (read) against 31.03%, 12.09%, and 46.88% increase in EBL collection (number of unique titles) between 2010-2011, 2011-2012, and 2010-2012, respectively (Table 1). Approximately less than 10% (46,038/547,973: 8.40%) of EBL unique e-books were browsed by 38.30% of the ECU community (29,525/77,081), making for a total of 1.56 titles per user (46,038/29,525), in each of these three years. When it comes to reading less than 5% of EBL titles were read (25,225/547,973: 4.60%) by a quarter of ECU population (19,612/77,081: 25.44%), making 1.29 titles per user (25,225/19,612), approximately (Figure 4).

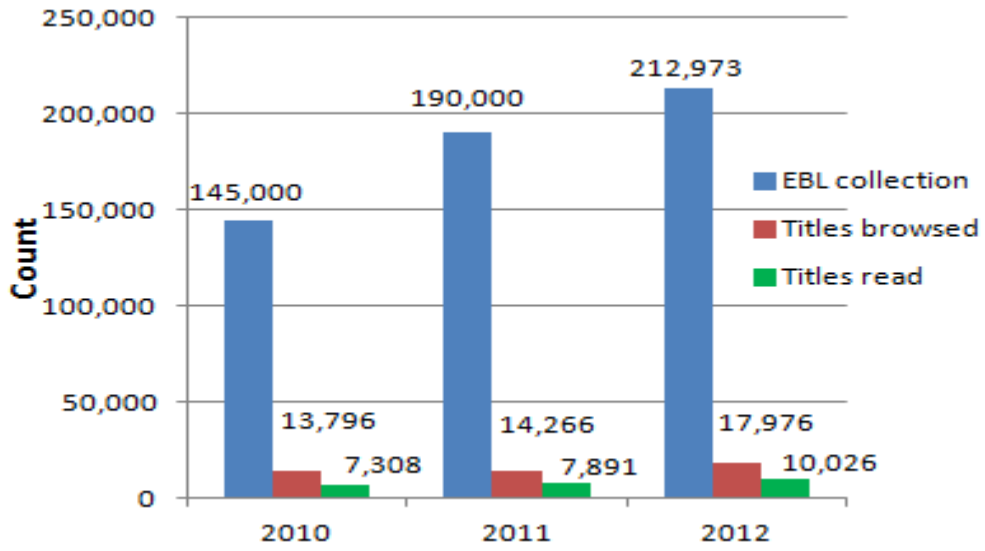


Figure 4. EBL collection and used titles comparison

Thirty-five per cent (35%) and 22% of the total, unique e-books used (browsed or read at least once) in 2010, also received usage in 2011 and 2012, respectively. Thirty-five per cent of the titles used in 2011 and 2012 were common according to duplicate ISBNs in both years. Out of 46,042 titles used in three years, 10,422 (22.64%) were used every year, suggesting the status of these titles as textbooks or embedded links. However, Bucknell (2010, p. 131) claims that "past usage is not a good predictor of future usage" based on e-book usage reports.

Data on titles show that the majority (64.43%) of the browsing users entered the reading mode at least once with a browsed title. Similarly, 54.79% of the browsed titles were read by one or more users. Table 5 shows these statistics in which the majority of transactions/views, users, and titles fall in the 1-9 minutes category.

Table 5. Comparison of Minutes, Users, and Titles

Transaction Category	Frequency	Sum of Minutes	Users*	Titles*
0 minute	72,232	0	3,620	8,991
1-9 minutes	125,534	448,379	9,609	19,321
10-29 minutes	12,977	224,522	4,659	5,660
30-59 minutes	7,248	305,810	2,691	3,120
60-99 minutes	4,898	382,539	1,888	2,007
100-249 minutes	6,277	971,231	3,072	3,131
250-499 minutes	2,224	762,528	1,749	1,638
500-999 minutes	1,022	714,857	1,102	1,019
=>1,000 minutes	801	1,013,853	1,135	1,155
Total	**233,213**	**4,823,719**	**29,525**	**46,042**

*Year-wise unique; browsing & reading combined.

Few of the users and titles accounted for most usage in terms of total views and sum of minutes in combined browsing and reading modes. On average only 15% of users consumed 83% of total minutes in each of three years, 2010-2012. Similarly, 20% of users made nearly 67% of all views/transactions. Ten per cent of titles consumed 83% of total minutes and 20% of titles explained 68% of all views (Table 6).

Table 6. ECU E-book User Behavior

Use Behavior	2010	2011	2012
% of Minutes consumed by top 15% of users	86	88	75
% of Views by top 20% of users	68	67	65
% of Minutes consumed on top 10% of titles	86	85	78
% of Views on top 20% of titles	66	68	70

Figures rounded.

Use of e-books and the ECU academic calendar. E-books are used throughout the year as evident from Figure 5. The tendency for e-book utilisation to follow the academic calendar is consistent across 2010-2012. Use is concentrated around the months when the semester is in session, the assignment/project submission dates and the coursework study.

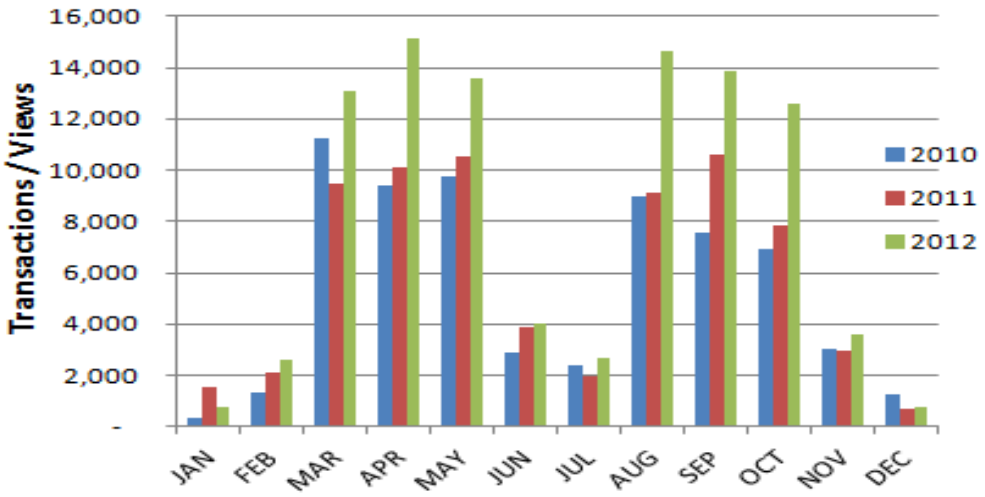


Figure 5. Month-wise e-book use at EBL

Daily cycle of e-book use. Monday is the most frequent day of the week for EBL e-book use, with Saturday, Sunday, and public holidays involving least use (Figure 6).

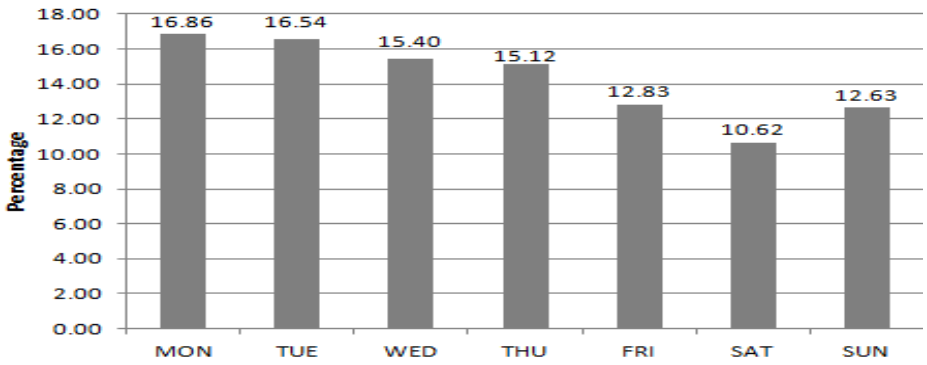


Figure 6. EBL daily use/transactions 2010

A review of the daily cycle of e-book use also reveals that most use occurs within the same time zone. Only 10% of ECU students reside in a different time zone (not UTC+8) (D. Ward, personal communication, August 29, 2012). Hence, most of the peaked data of Time are distributed between 11 am and 3 pm (Figure 7). At this academic library, e-book use is concentrated in its geographic time zone around the 9-5 p.m working day.

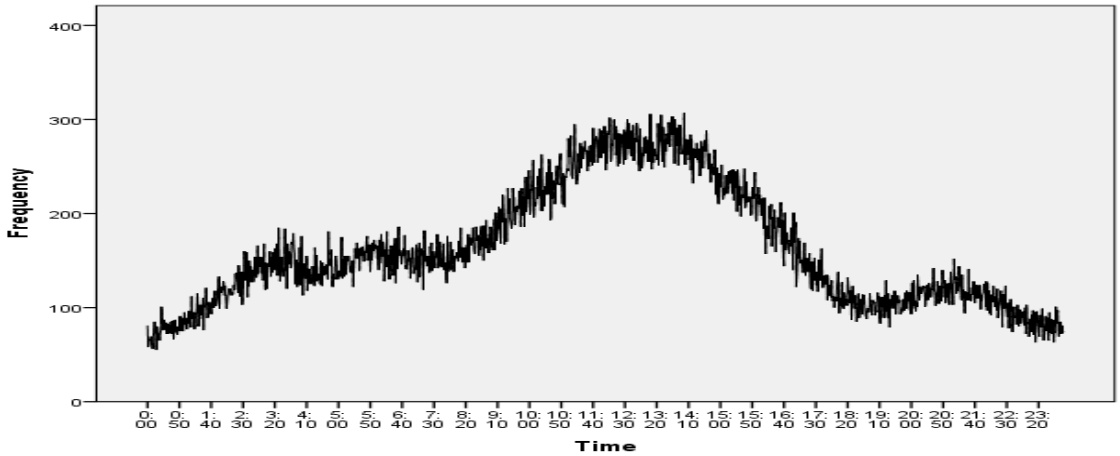


Figure 7. Time of EBL e-book use

User sessions and searches. As the ECU e-book user-base increased from 2010-2012, the intensity of e-book usage and engagement also increased. User sessions with EBL e-books were up 35.04% and 23.70% in 2012, from 2010 and 2011. A session starts when a user opens a title and performs at least one view, copy, print, or download. It ends when the user closes the EBL window or logs/times out. Over the period 2010-2012, an ECU e-book user conducted on average 6.07 sessions (comprising browsing and reading of one or more titles) annually. Sessions averaged 26.92 minutes with 1.30 titles (including 0.26 unique titles) viewed per session annually. The variable, *views* or *transactions*, is a sum of browsed and read use instances for all users and titles including repeating ones. A small cohort (15%) of views/transactions and unique users accounted for around half of the sessions in three years, 2010-2012 (Table 7).

Table 7. EBL User Sessions

Use Behavior	2010	2011	2012
% of Sessions conducted by top 15% of unique users	50.08	50.44	49.44
% of Sessions consumed by top 15% of views	48.11	49.06	47.68

There are two types of searches, regular and within a title. Regular searches are reported here which were conducted for e-books/titles directly on the EBL site and the e-books were opened from those searches. The ECU-EBL interface can be accessed via the ECU databases, ECU search interface, and embedded links. On average a user ran 1.73 searches in each of three reported years. These searches conducted between 2010-2011 and 2010-2012 increased 211% and 308% respectively. This substantial increase in searches is indicative of the ECU community's increasing engagement with e-books over the data collection period. Comparatively, the increase in unique titles viewed was modest (3.44% and 30.30%) between 2010-2011 and 2010-2012, respectively. However, no data were collected that enabled meaningful reflection on query efficiency. It is important to mention that searches for e-books performed from the Library's interface were not available to the researcher and, thus, not included in this study.

Item type (owned vs. un-owned e-books). Most frequently used titles are automatically purchased by ECU Library called 'owned' e-books in line with the patron-driven, auto-purchase acquisition, but these are still offered via EBL server and interface (D. Howard, personal communication, April 13, 2011). EBL refers to this schema as a demand-driven acquisition model. McLure and Hoseth (2012) explain that "after four, 24-hour short-term loans the fifth use triggers a perpetual access purchase of the title, which includes 325 non-linear uses per year renewed annually at no cost" (p. 140). On average ECU Library has auto-purchased/owned nearly one-fourth (23.33%) of the used e-books in each of three years, 2010-2012. Based on an average of three years, 2010-2012, owned e-books accounted for 53% of transactions (browsing 67%, reading 33%), and 63.43% of minutes (8% in browsing and 92% in reading) annually. Seventy-five (75) and 70 per cent of the owned e-books used (browsed or read) in 2010 also received usage respectively in 2011 and 2012. Seventy-four per cent of the owned titles used in 2011 and 2012 were common.

Out of 10,735 unique titles (23.32% of used e-books) owned by ECU Library in three years (2010-2012), 4,927 (46%) have been used every year. The data are consistent with the use of such titles as prescribed texts or embedded links. The number of year-wise unique users who used (only browsed or browsed and read) owned e-books were 5,867 (69%), 7,008 (75%), and 9,197 (79%) respectively for 2010, 2011, and 2012. The

repeating/duplicate/triplicate users were 1,906 (2010-11), 1,363 (2010-12), 2,627 (2011-12), and 5,048 (2010-11-12). These were the users who used both owned and non-owned e-books but here they were filtered for owned e-books only. Hence, the majority of users used owned e-books repeatedly.

Relationship between variables (Correlation). Kendall's tau-b (bivariate, two-tailed, N = 29,525) at ($\alpha = 0.01$) indicated the presence of a strong positive correlation of titles browsed with titles read ($\tau = .65$, $p < .001$). This result shows that users whose engagement is greater as measured by titles browsed are also more engaged in terms of converting browsing behavior to reading behavior. Similarly, more minutes are likely to be spent on reading, if more/maximum minutes (five for non-owned, 10 for owned e-books) are spent on browsing ($\tau = .48$, $p < .001$).

Discussion

A decrease in 2012 is observed in three variables (Total Minutes, Minutes in reading, and MinMax) based on minutes spent by users in browsing and/or reading, contrary to growth shown with other variables. Digital rights management (DRM) changes in policy explain the discrepancy. For example, in 2012 the loan period was reduced to a day, where previously it had been unlimited. The facility of downloading a title for offline use via Adobe Digital Edition (ADE) was initiated in 2012 and EBL has a separate method to record this offline usage. This change had the effect of reducing total Minutes, Minutes in reading, and MinMax as reading expanded to encompass offline as well as online reading. The pattern of year-on-year increase is consistent with other studies (e.g. Wells & Dumbell, 2010) and is consistent with growing user engagement with the format.

While the analysis outcome is consistent with prior studies (e.g. JISC, 2009, Nicholas, Rowlands, & Jamali, 2010) that e-books are preferred for fact-finding, skim reading and unsuited to extended reading, since no data is available on query efficiency, the abandonment of titles for reasons of irrelevancy cannot be excluded as an explanation. Cumulative frequency data do however support the proposition of skim reading and unsuitability for extended reading with only 15.1% of transactions over the three survey years meeting the standard of extended reading if this standard is set at the lower threshold of ten minutes or more. Concerning previous research, for example, McLure and Hoseth (2012), based on an eight-month transaction analysis of EBL e-book usage at the Colorado State University (USA), also found 68.50% of the browsing users entered the reading mode at least once. Hence the data show that whilst user abandonment of titles is most typical, around two-thirds of users enter the reading mode at least once in each of the reported years.

Around 85% of transactions/views by minutes are below 10 minutes, whereas 0-minute views are around 31%. The data are consistent with skim (or reference) and quick, snippet fact extraction use of e-books and supportive of prior studies (e.g. JISC, 2009, Nicholas, Rowlands, & Jamali, 2010). Few of the users and titles accounted for most usage in terms of total views and sum of minutes in combined browsing and reading modes. On average only 15% of users consumed 83% of total minutes in each of three years, 2010-2012. Similarly, 20% of users made nearly 67% of all views/transactions. Ten per cent of titles consumed 83% of total minutes and 20% of titles explained 68% of all views. This is somewhat similar to the Twitter research where the top 10% of prolific Twitter users accounted for 90% of tweets (Heil & Piskorski, 2009).

The year-wise frequently used titles accounted for 8.47%, 7.41%, and 7.59% of total Minutes respectively for 2010, 2011, and 2012. This trend also shows the embedded/prescribed nature of some of the titles linked in course units' outlines. These outlines were accessible through the search function at the ECU website before 2012, for

example, this researcher searched a particular e-book title and the results showed all those outlines in which that title was embedded. The result may also be aligned with the culture of use and habituation/automaticity as explanations of user behavior. Preference for the format as measured by titles browsed displays cross over effects with titles read.

The months of March, April, and May in the first semester and August, September, and October in the second semester attract the most use as measured by log transactions. Enthusiasm for e-books appears greatest at or near the assignment submission points in both the semesters (showing a tendency in the data to closely reflect academic cycles). These are the months when students study coursework, prepare and submit assignments. It appears that e-book utilisation for examination (June and November) is very low. The lowest use months, January, February, July (orientation months), and December, fall mostly during semester breaks and the e-books in these months seem only to be used by the research students and academic staff.

Conclusion

Figure 8 presents a summary view of EBL use at ECU in three years, 2010-2012, across all the variables of interest.

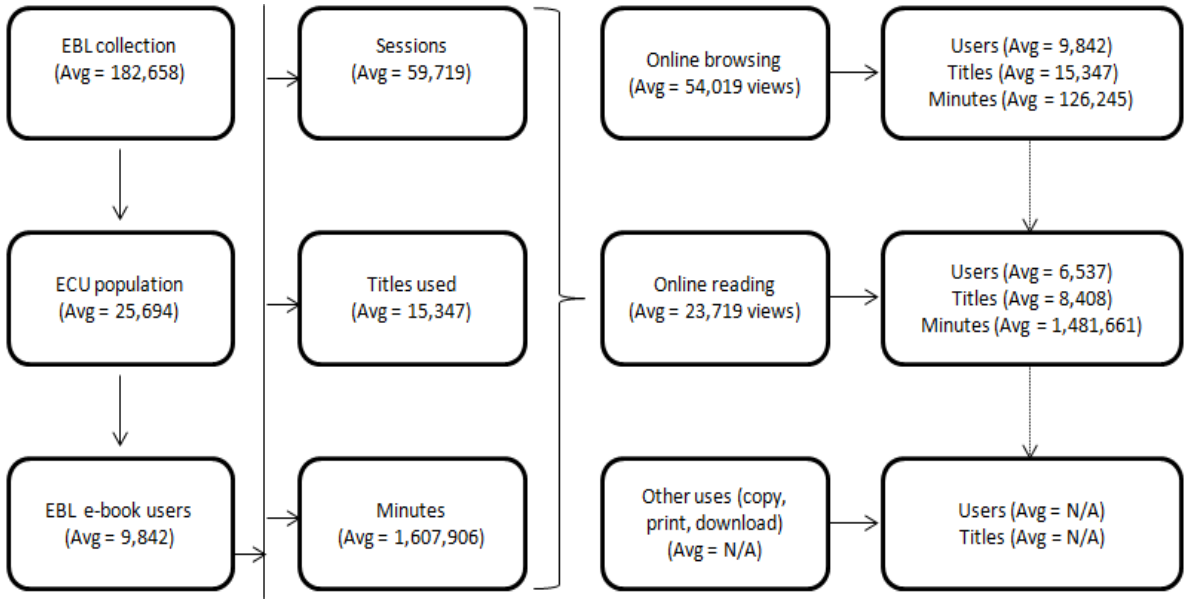


Figure 8. Summary of EBL e-books use at ECU 2010-2012

On average 38.30% of the ECU population made use of EBL e-books in each of three years, 2010-2012. Since the introduction of the EBL platform in 2010, the ECU user base has been growing. An increase of 10.27% from 2010 to 2011, 24.99% from 2011 to 2012 and 37.82% from 2010 to 2012 in users were recorded. Growth aligns with increased awareness in the ECU population and higher activity levels arising from more embedded courseware links. Viewing of EBL e-books (69.49% browsing; 30.51% reading) also grew, 8.53% (2010-11), 37.49% (2011-12), and 49.21% (2010-12) aligned with increase in EBL e-book titles. However, 33.58% of users only browsed and did not enter the reading mode. EBL e-book use increased gradually in every year, 2010-2012, across all the variables except Total Minutes, Minutes in Reading, and Minutes Max in 2012. Explanation of decrease in these three variables includes skim or reference use, DRM restrictions, and preference for offline use of

e-books via downloads or printouts. This is also evident from other metrics, for example, 30.97% of views could not go beyond 0 (zero) minutes; 53.83% of views remained between 1 (one) and 9 (nine) minutes, and only 15.20% of transactions could yield 10 or more minutes.

On average, less than 10 per cent (8.40%) and less than five per cent (4.60%) of EBL unique e-books were browsed and read by 38.30% and 25.44% of the ECU community, respectively in each of three reported years. Ten per cent of titles consumed 83% of total minutes and 20% of titles explained 68% of all views. The result is consistent with embedded courseware links as an independent and controlling variable and how academic adoption of e-book texts fundamentally shape behavior.

Less than half (45.21%) of the titles were abandoned after browsing, but the majority of users (66.43%) continued reading after browsing. On average, only 15% of users accounted for 83% of total minutes and almost half of the total sessions in each of three years, 2010-2012. Similarly, 20% of users made nearly 67% of all views/transactions. From these figures, the idea of power use and users emerged and demanded further research. ECU Library auto purchased less than a quarter (23.33%) of the used EBL e-books every year. Most usage was concentrated around those auto purchased e-books due to the likely reasons of being textbooks or having embedded links. The librarians may use the findings of this study to make evidence-based informed decisions while selecting the e-book acquisition model of aggregator/supplier platforms.

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