

Research Article

Analyzing the Extent of Inequality in the Time Uptake of Postgraduate users of Central Library: A Gender Study

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A B S T R A C T

In this paper we have applied the Quantile technique to analyze the inequality in the time consumption of Postgraduate students belonging to 4 disciplines of Annamalai University. The disciplines Chemistry, Computer Science, Maths and Physics were classified according to the pattern of user's time consumption level in the Library across gender. A Quantile technique has been applied to analyze the sample. The Distribution function, Lorenz function, Lorenz Plot (Lorenz M. O. 1905) and Gini Coefficient (Gini C. 1909) were obtained through this technique. The framed research question is; what is the extent of gender inequality in the time consumption? The extracted Gini coefficient values for various disciplines are; Chemistry (male=0.000, female=0.106), Computer Science (male=0.000, female=0.000), Maths (male=0.000, female=0.060) and Physics (male=0.000, female=0.000). Modern Librarians are in need of new techniques to measure the users' attitudes so as they can admin their Libraries in order to deal the real problems effectively and efficiently (Saravanan T. 2013a & 2017).

Keywords: Library, Users Study, Time Consumption, Quantile Analysis, Gini Coefficient, Lorenz Distribution

Introduction

Assessing modern user's time consumption in the library is an important task now a day as it helps to evaluate the modern libraries usage level. The valuable sources may attract the modern users to the Library. Users may spend more time in the library when they meet their demands. Based on the user's Time consumption in the library the Librarian can trace the user's information seeking attitudes in order to improve their library sources and services. A research technique namely Quantile method is opted in this study to extract the 4 disciplines user's time consumption level across their gender to trace the inequality. Nagpaul, P.S. (1999) conducted a study using a Quantile method,

which is available in UNESCO's WinIDAMS Archives. This paper focuses on users' time consumption in the library only. Study examines the inequality of users' time consumption level towards their gender. Librarians should adopt the suitable statistical tools in order to measure the growth of their libraries (Saravanan T., 2013b & 2017). This study has applied the statistical method named as Quantile. The variations noted obviously limit the interpretation and results of this study.

Objectives

The following objectives have been formulated in this study:

- To find out the actual locations of the obtained observations towards the cross tabulations.

- To trace the distribution function, Lorenz function and Gini coefficient for the select 4 disciplines user's gender by way of generating a graphical aid namely Lorenz Plot.
- To give a few suggestions for the modern Librarians.

Research Design

The population was close to 450, where 216 samples comprising of 4 disciplines namely Chemistry, Computer Science, Maths and Physics were vouched for the present study. The questionnaires were distributed to the select users and collected back in a framed time. The required samples were obtained using Stratified Random Sampling procedure. Five (5) response categories were used: One hour, Two hours, Three hours, Four hours and Five hours for time consumption. Based on the respondents' time consumption, the 4 disciplines respondents' responses have been further analyzed in order to find out the inequality using a Quantile method, which generates the Distribution function, Lorenz function, Lorenz Plot (Lorenz M. O. 1905) and Gini Coefficient (Gini C. 1909). The Gini coefficient is a measure of statistical dispersion intended to represent the inequality among values of a frequency distribution. A Gini coefficient of zero expresses perfect equality. A Gini coefficient of 1 (or 100%) expresses maximal inequality among values. The Lorenz curve is the graphical/ visual representation of frequency distribution.

59.62% of the male users and 40.38% of the female users are found in the Chemistry discipline as shown in the Table 1. 86.54% of the users have spent 1 hour time and rests

of the 13.46% are traced with 2 hours time consumption. Table 1.1 explores the distribution function and Lorenz function for the male users observed in Chemistry.

Table 1. Chemistry-Frequency Distribution

Discipline	Gender	1 hour	2 hours	Total
Chemistry	Male			
	Freq.	30	1	31
	Row %	96.77	3.23	100
	Col %	66.67	14.29	59.62
	Tot %	57.69	1.92	59.62
	Female			
	Freq.	15	6	21
	Row %	71.43	28.57	100
	Col %	33.33	85.71	40.38
	Tot %	28.85	11.54	40.38
	Total			
	Freq.	45	7	52
	Row %	86.54	13.46	100
	Col %	100	100	100
Tot %	86.54	13.46	100	

The observed Gini coefficient for the male users is 0.000 as shown in the Table 1.1. The area between distribution line and the Lorenz curve indicates the perfect equality in male users' Time consumption (Figure-1).

```

Analysis 1      MALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N: 31
Distribution and Lorenz function for number of subintervals = 31      Variable no. = 4
Time_Spent

*** Distribution function ***
*****
Minimum = 1.000

(1) 1.000
(2) 1.000
(3) 1.000
(4) 1.000
(5) 1.000
(6) 1.000
(7) 1.000
(8) 1.000
(9) 1.000
(10) 1.000
(11) 1.000
(12) 1.000
(13) 1.000
(14) 1.000
(15) 1.000
(16) 1.034
(17) 1.068
(18) 1.103
(19) 1.137
(20) 1.172
(21) 1.206
(22) 1.240
(23) 1.275
(24) 1.309
(25) 1.344
(26) 1.378
(27) 1.412
(28) 1.447
(29) 1.481
(30) 1.983

Maximum = 2.000
Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum = 0.031

0.032
0.065
0.097
0.129
0.161
0.194
0.226
0.258
0.290
0.323
0.355
0.387
0.419
0.452
0.484
0.516
0.548
0.581
0.613
0.645
0.677
0.710
0.742
0.774
0.806
0.839
0.871
0.903
0.935
0.998

Maximum = 1.000

```

Table 1(I). Chemistry-Male Users

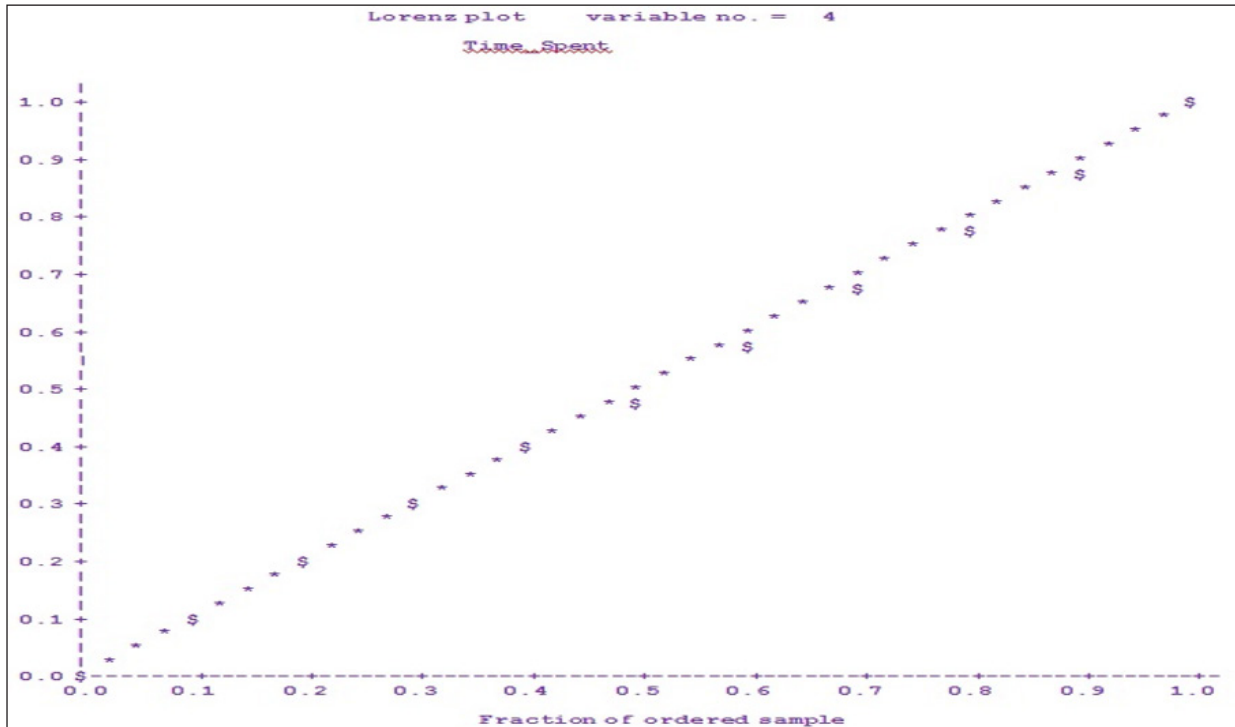


Figure 1. Chemistry-Lorenz Plot for Male Users

Table I (2). Chemistry-Female Users

```

Analysis 1    FEMALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N: 21
Distribution and Lorenz function for number of subintervals = 21    Variable no. = 4
Time Spent
*** Distribution function ***
*****
Minimum = 1.000
(1) 1.000
(2) 1.000
(3) 1.000
(4) 1.000
(5) 1.000
(6) 1.000
(7) 1.000
(8) 1.025
(9) 1.095
(10) 1.165
(11) 1.235
(12) 1.305
(13) 1.375
(14) 1.444
(15) 1.848
(16) 1.710
(17) 1.885
(18) 2.000
(19) 2.000
(20) 2.000
Maximum = 2.000
Gini coefficient = 0.106

*** Lorenz function ***
*****
Minimum = 0.037
0.039
0.078
0.116
0.155
0.194
0.233
0.272
0.310
0.349
0.388
0.427
0.466
0.504
0.543
0.608
0.686
0.764
0.841
0.919
0.996
Maximum = 1.000
    
```

Table 1.2 explores the distribution function and Lorenz function for the female users observed in Chemistry. The observed Gini coefficient for the female users is 0.106

as shown in the Table 1.2. The area between distribution line and the Lorenz curve indicates the inequality in female users' Time consumption (Figure-1.1).

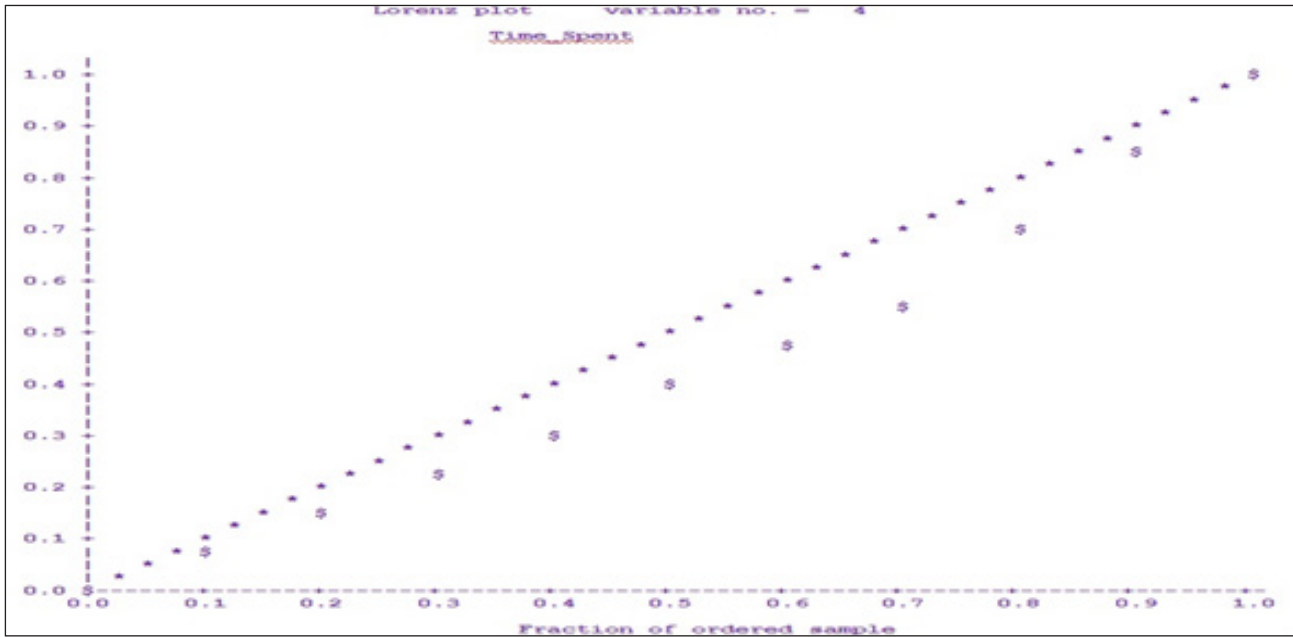


Figure 1(I).Chemistry-Lorenz Plot for Female Users

Table 2.Computer Science-Frequency Distribution

Discipline	Gender	3 hours	4 hours	Total
Computer Science	Male			
	Freq.	3	23	26
	Row %	11.54	88.46	100
	Col %	60	43.4	44.83
	Tot %	5.17	39.66	44.83
	Female			
	Freq.	2	30	32
	Row %	6.25	93.75	100
	Col %	40	56.6	55.17
	Tot %	3.45	51.72	55.17
	Total			
	Freq.	5	53	58
	Row %	8.62	91.38	100
	Col %	100	100	100
Tot %	8.62	91.38	100	

Table 2, explores the sample distribution for the discipline Computer Science. Of the total 58 respondents from Computer Science, 44.83% are male users while 55.17% are female users. 8.62% of the users are traced with 3 hours time consumption followed by 91.38% for 4 hours. Table 2.1 explores the distribution function and Lorenz function for the male users observed in Computer Science. The observed Gini coefficient for the male users is 0.000 as shown in the Table 2.1. The area between distribution line and the Lorenz curve indicates the equality in male

users' Time consumption (Figure-2).

Table 2.2 explores the distribution function and Lorenz function for the female users observed in Computer Science. The observed Gini coefficient for the female users is 0.000 as shown in the Table 2.2. The area between distribution line and the Lorenz curve indicates the equality in female users' Time consumption (Figure-2.1).

Table 3, explores the sample distribution for the discipline Maths. Of the total 51 respondents from Maths, 39.22% are

Table 2(1).Computer Science male Users

```

Analysis 1      MALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N: 26
Distribution and Lorenz function for number of subintervals = 26      Variable no. = 4
Time spent

*** Distribution function ***
*****
Minimum = 3.000

(.1) 3.000
(.2) 3.026
(.3) 3.410
(.4) 3.528
(.5) 3.574
(.6) 3.619
(.7) 3.664
(.8) 3.709
(.9) 3.754
(10) 3.799
(11) 3.844
(12) 3.890
(13) 3.935
(14) 3.980
(15) 4.000
(16) 4.000
(17) 4.000
(18) 4.000
(19) 4.000
(20) 4.000
(21) 4.000
(22) 4.000
(23) 4.000
(24) 4.000
(25) 4.000

Maximum = 4.000
Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum = 0.030

0.031
0.062
0.094
0.135
0.176
0.217
0.258
0.299
0.340
0.382
0.423
0.464
0.505
0.546
0.587
0.628
0.669
0.711
0.752
0.793
0.834
0.875
0.916
0.957
0.998

Maximum = 1.000
    
```

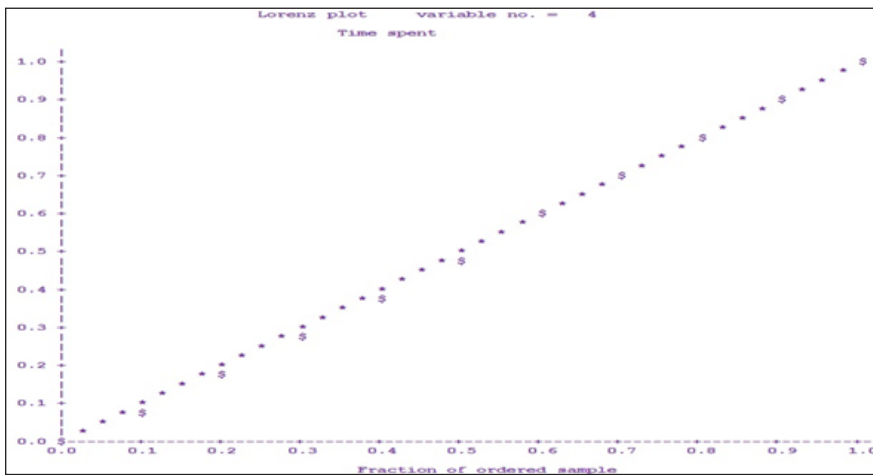


Figure 2.Computer Science-Lorenz Plot for Male Users

Table 2(2).Computer Science-Female Users

```

Analysis 1      FEMALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N: 32
Distribution and Lorenz function for number of subintervals = 32      Variable no. = 4
Time spent

*** Distribution function ***
*****
Minimum = 3.000

(.1) 3.000
(.2) 3.297
(.3) 3.520
(.4) 3.554
(.5) 3.589
(.6) 3.623
(.7) 3.657
(.8) 3.692
(.9) 3.726
(10) 3.760
(11) 3.795
(12) 3.829
(13) 3.864
(14) 3.898
(15) 3.932
(16) 3.967
(17) 4.000
(18) 4.000
(19) 4.000
(20) 4.000
(21) 4.000
(22) 4.000
(23) 4.000
(24) 4.000
(25) 4.000
(26) 4.000
(27) 4.000
(28) 4.000
(29) 4.000
(30) 4.000
(31) 4.000

Maximum = 4.000
Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum = 0.024

0.025
0.050
0.082
0.115
0.148
0.181
0.213
0.246
0.279
0.312
0.344
0.377
0.410
0.442
0.475
0.508
0.541
0.573
0.606
0.639
0.672
0.704
0.737
0.770
0.803
0.835
0.868
0.901
0.934
0.966
0.999

Maximum = 1.000
    
```

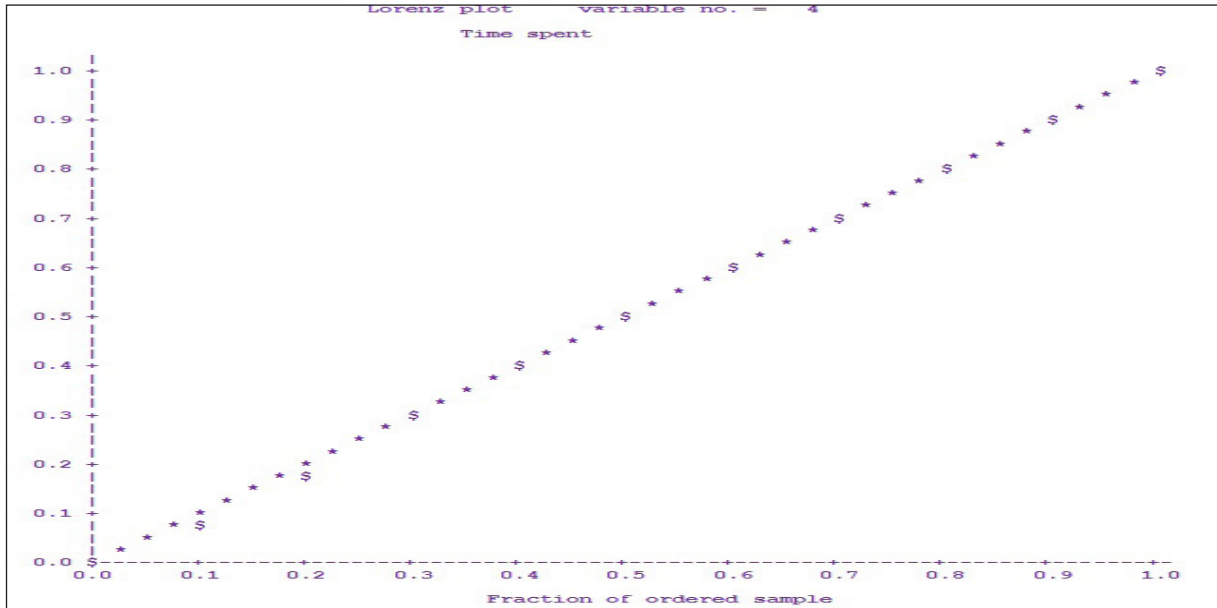


Figure 2(I).Computer Science -Lorenz Plot for Female Users

Table 3.Maths-Frequency Distribution

Discipline	Gender	2 hours	3 hours	Total
Maths	Male			
	Freq.	18	2	20
	Row %	90	10	100
	Col %	58.06	10	39.22
	Tot %	35.29	3.92	39.22
	Female			
	Freq.	13	18	31
	Row %	41.94	58.06	100
	Col %	41.94	90	60.78
	Tot %	25.49	35.29	60.78
	Total			
	Freq.	31	20	51
	Row %	60.78	39.22	100
	Col %	100	100	100
Tot %	60.78	39.22	100	

male users while 60.78% are female users. 60.78% of the users are traced with 2 hours time consumption and the remaining 39.22% of the respondents have spent 3 hours in the Library. Table 3 explores the distribution function and Lorenz function for the male users observed in Maths.

Table 3.1 explores the distribution function and Lorenz function for the male users observed in Maths. The

observed Gini coefficient for the male users is 0.000 as shown in the Table 3.1. The area between distribution line and the Lorenz curve indicates the equality in male users' Time consumption (Figure-3).

Table 3.2 explores the distribution function and Lorenz function for the female users observed in Maths. The observed Gini coefficient for the male users is 0.060 as

Table 3(I). Maths-Male Users

```

Analysis 1      MALE GENDER AND TIME CONSUMPTION IN THE LIBRARY

This analysis has been done on a subset of cases, adjusted N: 20
Distribution and Lorenz function for number of subintervals = 20      Variable no. = 4
Time spent

*** Distribution function ***
*****
Minimum =      2.000

(.1)      2.000
(.2)      2.000
(.3)      2.000
(.4)      2.000
(.5)      2.000
(.6)      2.000
(.7)      2.000
(.8)      2.000
(.9)      2.000
(10)      2.056
(11)      2.114
(12)      2.172
(13)      2.231
(14)      2.289
(15)      2.347
(16)      2.406
(17)      2.464
(18)      2.947
(19)      3.000

Maximum =      3.000
Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum =      0.048

0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
0.450
0.500
0.550
0.600
0.650
0.700
0.750
0.800
0.850
0.921
0.996

Maximum =      1.000
    
```

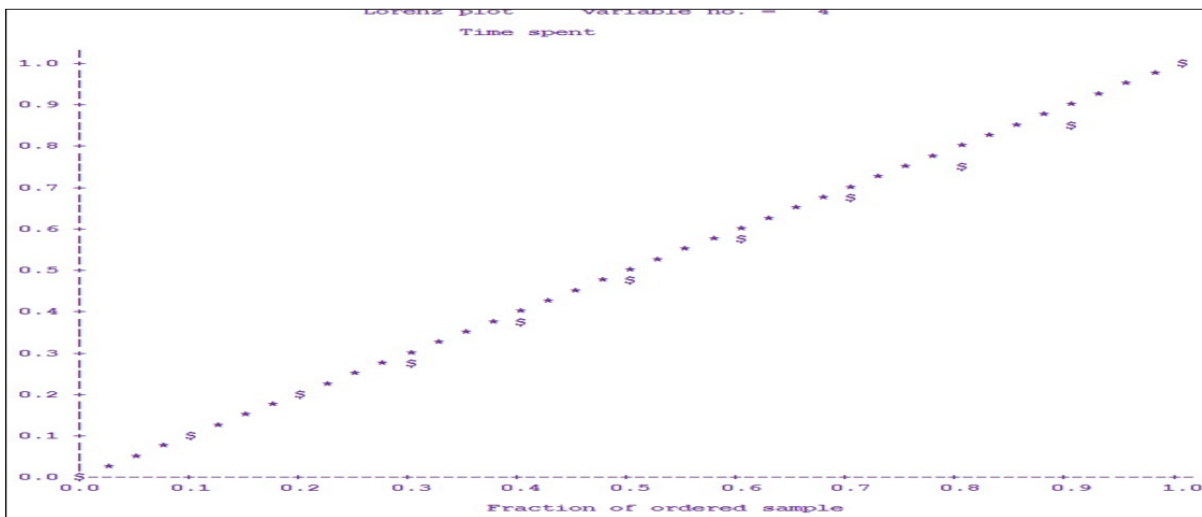


Figure 3. Maths-Lorenz Plot for Male Users

Table 3(2). Maths-Female Users

```

Analysis 1      FEMALE GENDER AND TIME CONSUMPTION IN THE LIBRARY

This analysis has been done on a subset of cases, adjusted N: 31
Distribution and Lorenz function for number of subintervals = 31      Variable no. = 4
Time spent

*** Distribution function ***
*****
Minimum =      2.000

(.1)      2.000
(.2)      2.000
(.3)      2.000
(.4)      2.000
(.5)      2.000
(.6)      2.000
(.7)      2.017
(.8)      2.097
(.9)      2.176
(10)      2.256
(11)      2.335
(12)      2.414
(13)      2.687
(14)      2.553
(15)      2.610
(16)      2.668
(17)      2.725
(18)      2.782
(19)      2.840
(20)      2.897
(21)      2.954
(22)      3.000
(23)      3.000
(24)      3.000
(25)      3.000
(26)      3.000
(27)      3.000
(28)      3.000
(29)      3.000
(30)      3.000

Maximum =      3.000
Gini coefficient = 0.060

*** Lorenz function ***
*****
Minimum =      0.025

0.026
0.052
0.077
0.103
0.129
0.155
0.181
0.206
0.232
0.258
0.284
0.310
0.341
0.379
0.418
0.457
0.496
0.534
0.573
0.612
0.650
0.689
0.728
0.767
0.805
0.844
0.883
0.921
0.960
0.999

Maximum =      1.000
    
```

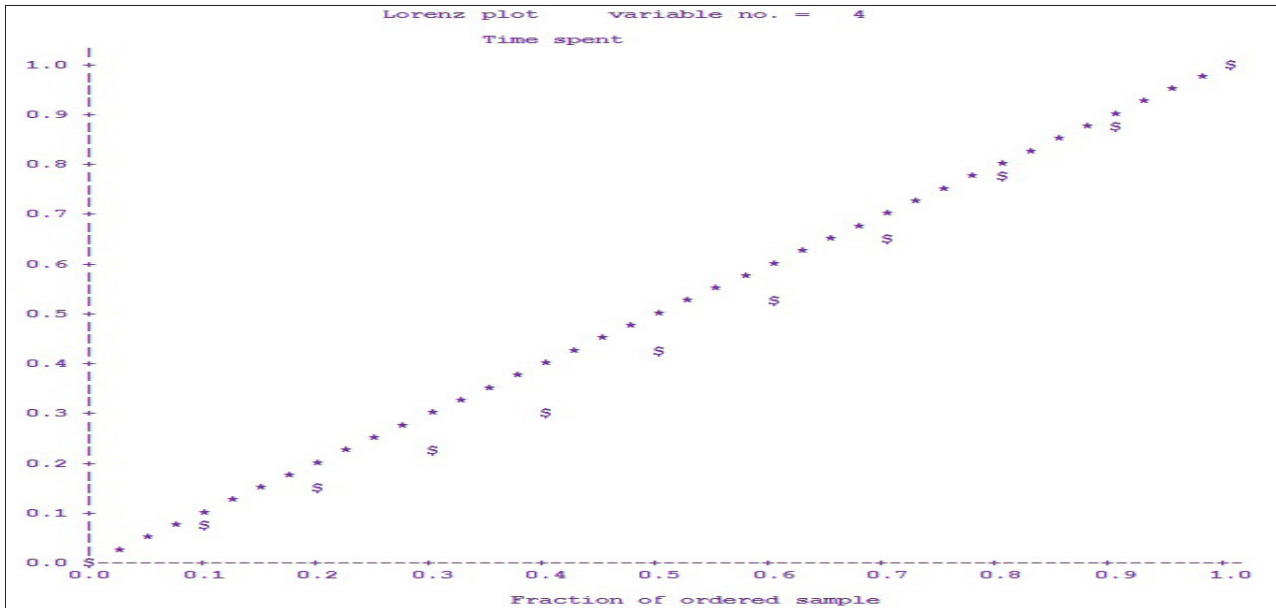


Figure 3(I).Maths-Lorenz Plot for Female Users

Table 4.Physics-Frequency Distribution

Discipline	Gender	2 hours	3 hours	4 hours	Total
Physics	Male				
	Freq.	3	18	0	21
	Row %	14.29	85.71	0	100
	Col %	100	36.73	0	38.18
	Tot %	5.45	32.73	0	38.18
	Female				
	Freq.	0	31	3	34
	Row %	0	91.18	8.82	100
	Col %	0	63.27	100	61.82
	Tot %	0	56.36	5.45	61.82
	Total				
	Freq.	3	49	3	55
	Row %	5.45	89.09	5.45	100
	Col %	100	100	100	100
Tot %	5.45	89.09	5.45	100	

shown in the Table 3.2. The area between distribution line and the Lorenz curve indicates the inequality in female users' Time consumption (Figure-3.1).

Table 4 explores the sample distribution of the discipline Physics. Of the total 55 respondents from Physics, 38.18% are male users while 61.82% are female users. 5.45% of the users are traced with 2 hours time consumption followed by 89.09% of the users with 3 hours and rests of the 5.55% have spent 4 hours in the library.

Table 4.1 explores the distribution function and Lorenz

function for the male users observed in Physics. The observed Gini coefficient for the male users is 0.000 as shown in the Table 4.1. The area between distribution line and the Lorenz curve indicates the equality in male users' Time consumption (Figure-4).

Table 4.2 explores the distribution function and Lorenz function for the female users observed in Physics. The observed Gini coefficient for the female users is 0.000 as shown in the Table 4.2. The area between distribution line and the Lorenz curve indicates the equality in female user's Time consumption (Figure-4.1).

Table 4(1).Physics-Male Users

```

Analysis 1      MALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N:  21
Distribution and Lorenz function for number of subintervals = 21      Variable no. =  4

Time spent

*** Distribution function ***
*****
Minimum =          2.000

(1)      2.000
(2)      2.032
(3)      2.429
(4)      2.538
(5)      2.597
(6)      2.655
(7)      2.713
(8)      2.771
(9)      2.829
(10)     2.888
(11)     2.946
(12)     3.000
(13)     3.000
(14)     3.000
(15)     3.000
(16)     3.000
(17)     3.000
(18)     3.000
(19)     3.000
(20)     3.000

Maximum =          3.000

Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum =          0.033

(1)      0.035
(2)      0.070
(3)      0.107
(4)      0.160
(5)      0.212
(6)      0.264
(7)      0.317
(8)      0.369
(9)      0.421
(10)     0.474
(11)     0.526
(12)     0.579
(13)     0.631
(14)     0.683
(15)     0.736
(16)     0.788
(17)     0.840
(18)     0.893
(19)     0.945
(20)     0.998

Maximum =          1.000
    
```

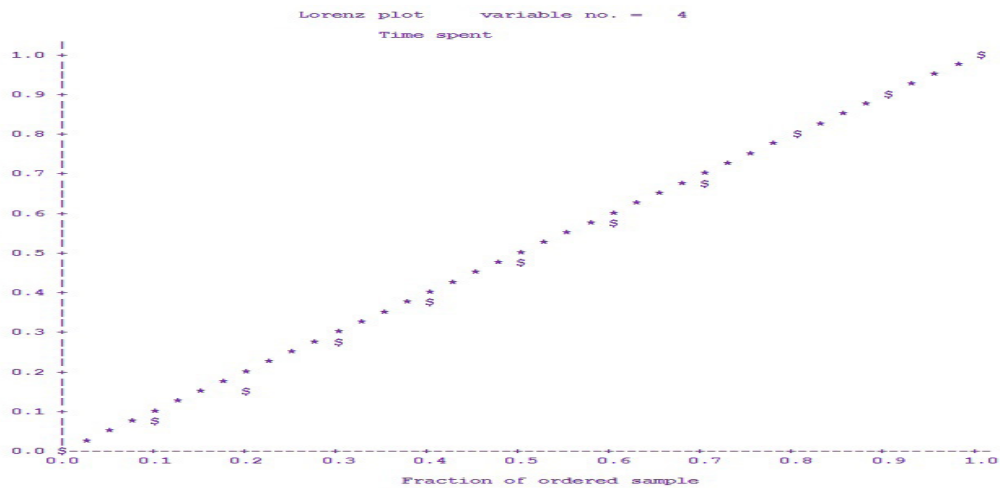


Figure 4. Physics-Lorenz Plot for Male Users

Table 4(2).Physics-Female Users

```

Analysis 1      FEMALE GENDER AND TIME CONSUMPTION IN THE LIBRARY
This analysis has been done on a subset of cases, adjusted N:  34
Distribution and Lorenz function for number of subintervals = 34      Variable no. =  4

Time spent

*** Distribution function ***
*****
Minimum =          3.000

(1)      3.000
(2)      3.000
(3)      3.000
(4)      3.000
(5)      3.000
(6)      3.000
(7)      3.000
(8)      3.000
(9)      3.000
(10)     3.000
(11)     3.000
(12)     3.000
(13)     3.000
(14)     3.000
(15)     3.000
(16)     3.015
(17)     3.048
(18)     3.082
(19)     3.115
(20)     3.148
(21)     3.181
(22)     3.214
(23)     3.248
(24)     3.281
(25)     3.314
(26)     3.347
(27)     3.380
(28)     3.414
(29)     3.447
(30)     3.480
(31)     3.954
(32)     3.980
(33)     4.000

Maximum =          4.000

Gini coefficient = 0.000

*** Lorenz function ***
*****
Minimum =          0.029

(1)      0.029
(2)      0.059
(3)      0.088
(4)      0.118
(5)      0.147
(6)      0.176
(7)      0.206
(8)      0.235
(9)      0.265
(10)     0.294
(11)     0.324
(12)     0.353
(13)     0.382
(14)     0.412
(15)     0.441
(16)     0.471
(17)     0.500
(18)     0.529
(19)     0.559
(20)     0.588
(21)     0.618
(22)     0.647
(23)     0.676
(24)     0.706
(25)     0.735
(26)     0.765
(27)     0.794
(28)     0.824
(29)     0.853
(30)     0.882
(31)     0.920
(32)     0.960
(33)     0.999

Maximum =          1.000
    
```

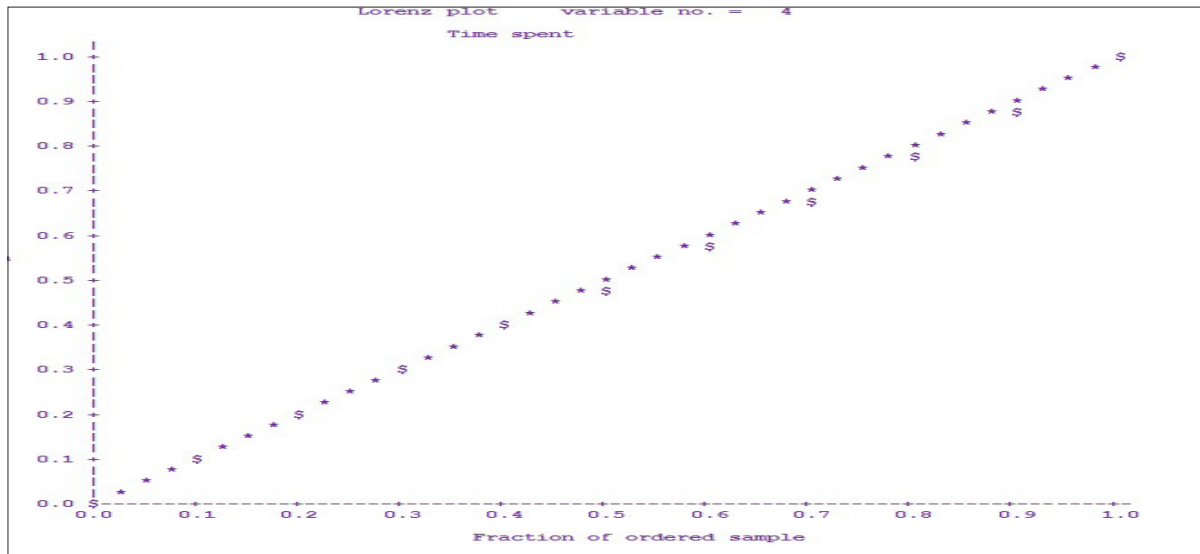


Figure 4(1).Physics-Lorenz Plot for Female Users

Determinations

The extracted results from the study are explored here. The Gini coefficient is treated as the most commonly used measures of inequality. While the Gini coefficient is often used to measure income and wealth inequality, it is also widely employed to indicate uneven distribution in other social issues. The Gini coefficient is calculated based on the Lorenz curve (Lorenz, M. O. 1905) distribution. The diagonal or 45 degree line indicates a perfect equality. The Gini coefficient is the ratio of the area between the Lorenz curve and the diagonal line. The discipline wise users' time consumption levels in the library across gender have been discussed below. Further, they give an answer for the structured research question. I.e. what is the extent of gender inequality in the time consumption?

Chemistry

The value of Gini coefficient for male group is 0.000. The results obtained for the male users imply that there is equality in the distribution of time consumption. The value of Gini coefficient for female group is 0.106. The results obtained for the female users imply that there is inequality in the distribution of time consumption. Female users' time consumption is found with greater inequality than the male users' Time consumption.

Computer Science

The value of Gini coefficient for male group is 0.000. The results obtained for the male users imply that there is equality in the distribution of time consumption. The value of Gini coefficient for female group is 0.000. The results obtained for the female users imply that there is equality in the distribution of time consumption. Time consumption distribution is found with equality in both the gender category.

Maths

The value of Gini coefficient for male group is 0.000. The results obtained for the male users imply that there is equality in the distribution of time consumption. The value of Gini coefficient for female group is 0.060. The results obtained for the female users imply that there is inequality in the distribution of time consumption. Female users' time consumption is found with greater inequality than the male users' time consumption.

Physics

The value of Gini coefficient for male group is 0.000. The results obtained for the male users imply that there is equality in the distribution of time consumption. The value of Gini coefficient for female group is 0.000. The results obtained for the female users imply that there is equality in the distribution of time consumption. Time consumption distribution is found with equality in both the gender category.

Librarians may use this kind of analysis to find the equality/ inequality among the users' preferences of sources and services rendered by the libraries. Further, the reasons behind the time consumption may be considered for further analysis. The study results may let the modern Librarians to make their own choice in terms of library administration and management. A well experimental design and suitable statistical techniques are must for the Librarians to conduct the research in a right track so they can act as good decision makers. However, this type of analysis needs to be approached with more caution.

Summary

This study has used a Quantile method to examine 4 disciplines users' time consumption as self-reported by students at one university. It could be noted that there

is equality and inequality among the gender of various disciplines that deserve further investigation. By using suitable statistical methods and collecting data on actual usage of the time consumption one can raise the library usage and minimize operational costs. There would be no doubt that the modern librarians are expected to possess enough research skills in order to keep the library sources, services and the patrons in a stable form. Studies like this kind need to be conducted by the librarians often to assess the libraries and the patrons.

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