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Jamshid Beheshti

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BEYOND CIRCULATION STATISTICS: PATTERNS OF BOOK USE BY
UNDERGRADUATE STUDENTS IN AN ACADEMIC LIBRARY

by

Jamshid Beheshti

School of Library and Information Science

Submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Graduate Studies
The University of Western Ontario
London, Ontario
March 1987

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ABSTRACT

Librarians have used 'use' and 'user' studies as management techniques for improving and ensuring effective provision of information to the users. Many of these studies equate circulation statistics with the use of documents. The book-charge data are merely a representative of finding something of interest in the documents, and may not constitute 'use'. The primary focus of this research study is to investigate and measure the use of the documents by a specific group of users. Users are defined as the undergraduate students in two academic institutions and documents are the books that are borrowed by the students from the library systems.

Meier's item-use-day, Hamburg's exposure time, and Kantor's contact time were utilized to operationalize and measure 'use'. Two types of data were used: diachronous data were gathered by the diary method and synchronous data were collected by the telephone interviews. The results of the study show that:

- The cumulative distribution of book-use is of a linear-log type, similar in shape to a Bradford type

distribution.

- The distribution of contact times over retention period is stationary.

- The contact time frequency distribution belongs to a double parameter gamma distribution.

- The average contact time from a diachronous sample may be approximately estimated from the average contact time from a synchronous sample. The average total contact time per book is about twice the average daily contact time per book for the undergraduate students of the same university.

- Contact time does not depend on the students' major area of study.

- The average or median total contact times per student per twenty-four hour period are not significantly different between two academic institutions.

- Contact times are independent from the subject concentration of the books, or the purposes for which they are borrowed.

Some of the implications of this research study for the library managers have been discussed.

*Dedicated to
my parents, and
Shohreh, Bobak, and Parisa*

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I would like to thank the members of my advisory committee, Dr. Alexis J. Jamieson, Dr. Catherine L. Ross, and especially Dr. Jean M. Tague, the principal advisor, for all their time and valuable suggestions. I would like to express my appreciation to Dr. Helen Howard, Director, and the faculty and staff at the Graduate School of Library and Information Studies, McGill University, for their support and encouragement.

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A great body of professional expertise has been developed, the general aims of which have been to improve the provision of books and to facilitate readers' access to books. At the point where the reader and the book come together, it has been the librarian's habit to leave the happy pair and tiptoe quietly away, like a Victorian novelist.

Frank Hatt

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CHAPTER I

INTRODUCTION

The information explosion of the past few decades has resulted in multiplying the problems of managing today's libraries. Information centres and libraries have become more complex places, requiring sophisticated management techniques for their efficient functioning. Decisions have to be made, based on the available data, to ensure effective provision of information to users.

Use and user studies have assisted the managers of information centers and libraries to test and operationalize various decision options available to them for their particular environment. Jain listed over five hundred such studies in 1967, dating back as early as 1933.¹ A more recent source annotated more than one hundred journal articles published in the United States and Canada between 1960 and 1983 on the subject of "use

¹A.K.Jain, A Statistical Study of Book Use Supplemented with a Bibliography of Library Use Studies (Lafayette, Indiana: Purdue University, 1967).

patterns" alone.² Many of these studies have been based on user surveys, circulation statistics, and other similar data.

One of the most cited and comprehensive studies of use and users is by Fussler and Simon, who utilized circulation statistics in a research library to answer a "fundamental question":³

Will any kind of statistical procedure predict, with reasonable accuracy, the frequencies with which groups of books with defined characteristics, are likely to be used in a research library?

Since that study was conducted, many more have appeared with the same objective. However, with computer technology, techniques of data collection and analysis have grown tremendously in their sophistication. Morse⁴ and Chen⁵ used more complex mathematical and statistical tools to analyze a sample

²David F. Kohl, Circulation, Interlibrary Loan, Patron Use, and Collection Maintenance (Santa Barbara, Calif.: ABC-CLIO, Inc., 1986).

³Herman H. Fussler and Julian L. Simon, Patterns in the Use of Books in Large Research Libraries (Chicago: The University of Chicago Library, 1961), p. 4.

⁴P.M. Morse, Library Effectiveness: A Systems Approach (Cambridge, MA: The MIT Press, 1968).

⁵C.-C. Chen, Applications of Operations Research Models to Libraries: A Case Study of the Use of Monographs in the Francis A. Countway Library of Medicine, Harvard University (Cambridge, MA: The MIT Press, 1976).

of the circulation data. Recently, Ravichandra Rao⁶ wrote special computer programs to fit more than ten different theoretical distributions to circulation data from university libraries in Canada. Beheshti and Tague⁷ manipulated over 1.2 million book transaction records to test a proposed model of book use, and Burrell⁸ has been testing different distributions on public library book-charge data.

Circulation data also have been used to determine directly the availability of materials and measure user satisfaction or frustration. Buckland's comprehensive study dealing with book availability used circulation statistics from various universities with different loan policies to determine the rate of return of books.⁹ Another study measured user frustration by comparing a 'semester' and a 'four week' loan policy utilizing

⁶I.K. Ravichandra Rao, "Documents and User Distribution in Transaction Records of Canadian University Libraries" (Ph.D. dissertation, University of Western Ontario, 1981).

⁷Jamshid Beheshti and Jean M. Tague, "Morse's Markov Model of Book Use Revisited," Journal of the American Society for Information Science 35 (September 1984): 259.

⁸Quentin L. Burrell, "A Second Note on Ageing in a Library. Circulation Model: The Correlation Structure," Journal of Documentation 42 (June 1986): 114-128.

⁹M.K. Buckland, Book Availability and the Library User (Toronto: Pergamon Press Inc., 1975).

circulation statistics.¹⁰ Whether these studies form the bases of decisions regarding the length of the loan period or predicting the use distribution of a certain class of books, they all have one factor in common: they equate circulation with the use of documents. The statistics generated by the borrowing is merely a representative of the "expectations of finding something of utility or interest" in the documents¹¹, and may not constitute 'use' from the document, or individual's view point.¹²

Recently, some researchers have raised concerns about the adequacy of utilizing circulation data alone in conducting use and user studies. Broadus states that "most use studies so far are rather blunt. Our measurements are not precise enough. When a book is checked out, what does that really say about use?"¹³

¹⁰T. Saracevic, W. M. Shaw JR., and P. B. Kantor, "Causes and Dynamics of User Frustration in an Academic Library," College and Research Libraries 38 (January 1977): 7.

¹¹W. E. McGrath, "Relationships between Subject Characteristics and Use of Books in a University Library" (Ph.D. dissertation, Syracuse University, 1975), p. 19.

¹²N. Roberts, "Draft Definitions: Information and Library Needs, Wants, Demands, and Uses; a Comment," Aslib Proceedings 27 (1975): 312.

¹³R. N. Broadus, "Use Studies of Library Collections," Library Resources & Technical Services 24 (Fall 1980): 323.

Brittain has raised similar questions:¹⁴

very little attention has been paid to what happens to documents when they arrive upon a user's desk. How long do users spend reading documents of different types? . . . How long do users need to keep documents? Could the information in them be supplied in more efficient and effective forms. These, and many other questions about the use made of documents, have been almost totally neglected in library research.

The purpose of this research is to measure 'use' of the documents once they leave the library system.

Since many different variables may affect the outcome of an exploratory research study such as the one undertaken here, the parameters of the study have been limited to a specific group of users and documents. Users are defined as undergraduate students enrolled in general programs in a university. Documents are defined as those books which the students can borrow from the university library system on a regular basis. Therefore, the primary focus of this research is to determine the patterns of book use by undergraduate students in an academic library.

¹⁴J. M. Brittain, "Pitfalls of User Research, and Some Neglected Areas," Social Science Information Studies 2 (1982): 143.

1.1 Defining Use in Terms of Reading Process

When a book leaves the library system and becomes a circulation statistic, is it really used by the borrower? Since 'use' must inevitably mean 'reading' a document, a framework for investigating the reading process had to be considered in this research, although it was not directly used.

The main focus in reading research in the field of education has been on the acquisition and improvement of reading skills for the comprehension of texts.¹⁵ An online search of the ERIC database reveals that out of thousands of records on reading, less than one hundred items deal with reading in higher education. The majority of these are on reading difficulties encountered by college students and remedial suggestions. Defining what reading is has been the subject of discussion for some time¹⁶, but some earlier definitions indicate that it is a complex process. Horn states:¹⁷

¹⁵see various issues of Reading Research Quarterly, Journal of Reading, and Reading Research: Advances in Theory and Practice.

¹⁶J. T. Guthrie, "Meaning of 'Reading'," Journal of Reading 26 (1983): 750-751.

¹⁷ cited in M. V. Zintz, The Reading Process: The Teacher and the Learner (Dubuque, Iowa: Wm. C. Brown Company Publishers, 1980), p. 14.

reading includes those processes that are involved in approaching, perfecting, and maintaining meaning through the use of the printed page. Since there are many such processes, and since each one varies in degree, the term must be elastic enough to apply to all the varieties and gradations of reading involved in the use of books.

In relation to developing reading programs for children, Gates states that reading should "embrace all types of thinking, evaluating, judging, imagining, reasoning, and problem-solving."¹⁸

Reading has been the subject of study in other disciplines such as psychology, sociology, literary criticism, and more recently, psycholinguistics. The latter field is a combination of cognitive psychology and linguistics which attempt to "analyze and understand the language and thinking process, including reading, as it occurs in humans."¹⁹

Different models have been proposed to explain the reading process. Goodman suggests that:²⁰

reading is a selective process. It involves partial use of available minimal language cues selected from perceptual input on the basis of the reader's expectation. As this partial information is processed, tentative decisions

¹⁸ cited in Zintz, p. 15.

¹⁹Charles R. Cooper and Anthony R. Petrosky, "A Psycholinguistic View of the Fluent Reading Process," Journal of Reading 20 (December 1976): 184.

²⁰Kenneth S. Goodman, "Reading: A Psycholinguistic Guessing Game," Journal of the Reading Specialist (May 1967): 126-127.

are made, to be confirmed, repeated or refined as reading progresses.

Smith states that "the fact that we are not aware that this information [past knowledge] is available does not mean that we do not use it."²¹ In a recent work on the "Theoretical issues in reading comprehension", three major disciplines of cognitive psychology, linguistics, and artificial intelligence have been brought together to form a "comprehensive theory of the reading process."²² They concluded that reading consists of: analyzing the text from the letters to the text as a whole, pre-existing knowledge of the reader, inferring from the text by formulating hypotheses about the gist of the text, and strategies for meeting the purpose of reading.

In the field of library and information science, a number of studies were conducted in the thirties and forties on the impact and the social aspects of reading on the general public.²³ However, the recent research has been somewhat sporadic. An annotated bibliography

²¹Frank Smith, Understanding reading (2nd ed. New York, N.Y.: Holt, Rinehart, and Winston, 1978), p. 141.

²²Rand J. Spiro, Bertram C. Bruce, and William F. Brewer, ed., Theoretical Issues in Reading Comprehension: Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education (Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1980), p. 3.

²³S. Karetzky, "Reading Research and Librarianship to 1940: An Analysis" (Ph.D. dissertation, University of Columbia, 1978).

on user surveys of public libraries in United Kingdom lists only 126 documents published from 1900 to 1976 dealing with the subject of reading.²⁴ The majority of these studies are sociological in nature, dealing with reading habits, the socio-economic background of the readers and library users, and user satisfaction of the library services. Other studies have focused primarily on the circulation transactions and prediction models.

Frank Hatt has outlined a framework of the reading process which may be used as guideline in a reading research in the field of library and information science.²⁵ Hatt states that to define the reading process six basic questions should be addressed.

1. Who is the reader? the reader has several attributes which distinguish him/her from a non-reader, mainly the following: literacy, access to reading matter, time to read, and appropriate environment.

2. What does the reader want? A reader may be aware of his/her needs and wants and read towards fulfilling these, in which case his/her reading is called 'instrumental'. Or, he/she may choose reading as an end in itself, in which case the reading is referred to as 'terminal reading'. Whereas much of the past

²⁴Martin L. Ward, Readers and Library Users (London: Library Association, 1977).

²⁵Frank Hatt, The Reading Process: A Framework for Analysis and Description (London: Clive Bingley, 1976).

research in the field has emphasized the role of the book and its effect on the reader. Hatt claims that the reader should be the primary focus of future research.

3. What is the text? Traditionally, librarians have identified a book by some of its characteristics: size, number of pages, subject matter based on some classification scheme, etc. But other attributes may be used to classify a text such as: literary criticism, discourse analysis, content analysis, readability measures, etc.

4. How do the reader and text come together? A reader may start with a general and vague question or enquiry, the answer to which comprises several shelves of books in a library. As the reading act proceeds, the scope of the original question becomes narrower and the reader may proceed from browsing a shelf of books to browsing/reading a particular book, to a chapter, and a paragraph which may provide him/her with a satisfactory answer. The main point is not whether a reader browses the shelves or the catalogue to find a book, but how does he/she find a text which satisfies his/her needs and goals.

5. What is the nature of the reading? Hatt states that his outline is an expanded view of the nature of the reading process as defined by some psycholinguists. He summarises this process as the search for meaning in the words and sentences, and the "prediction and the

matching of the text against the reader's expectations." In particular, he states that both his and the psycholinguists' emphasis is on the "reader's store of prior knowledge, his goals, and the expectations he brings to the text."²⁶

6. What ensues from the reading? Or "what does the reader take away from the message?" has been addressed in several different disciplines such as: literary criticism, mass communication studies, and information-flow studies. Hatt describes eleven "patterns of exit from the reading," that the reader may choose. These patterns may be "applicable to any kind of reading act."

Hatt provides a framework that may clarify some of the complex concepts involved in the reading act. However, two basic obstacles hamper any attempt to conduct research on the subject of 'use' if it is defined in terms of the reading process. First, there is the problem of identification and definition of all the variables involved, from linguistic capabilities to prior stored knowledge of the reader. Secondly, operationalization of the defined variables and data collection will be an insurmountable task.

²⁶Ibid., p. 81.

1.2 Defining and Operationalizing Use

Defining and operationalizing 'use' have been the subject of discussion in the research literature of library and information science. The problem with defining 'use' arises because the term is understood differently by various individuals. Bookstein¹⁷, in a study focusing on problems resulting from differing interpretations of the term 'use' made by respondents to questionnaires, states:

If people do indeed differ in their application of the term "use" to various acts, then, for example, two people whose experience in a library are identical may, when asked about the extent of their library use, give very different answers, although both may sincerely be trying to cooperate with the investigator.

In an attempt to bring conceptual clarity to this research field, Line distinguishes among related terms. He defines what an individual "ought to have" as need, what he/she "would like to have" as want, what the individual "asks for" as demand, and "what an individual actually uses" as use. In this context, "a use may be a satisfied demand, or it may be the result of browsing or

¹⁷Abraham Bookstein, "On the Complexities of Asking Questions Difficulties in Interpretation of Library Surveys," in Library effectiveness: A state of the art: Papers from a 1980 ALA Preconference (Chicago: Library Administration and Management Association/ALA, 1980), 35-43.

accident (e.g. conversation) -- information recognized as a need or a want when received, although not previously articulated into a demand."²⁸ Roberts elaborates on Line's definition, stating that "only a fraction of Satisfied Demand finally results in Individual Use."²⁹

Morss and Rich have attempted to distinguish two definitions of use: instrumental and conceptual. Instrumental use can be documented because the information, has a direct effect on the user's decision-making process, whereas with conceptual use "one's thinking [changes] about an issue, but it is not possible to point to discrete data that led to a decision."³⁰ Here, the authors are specifically referring to use of information in policy making, although their definitions may also be used in other types of studies.

A related problem is measuring or operationalizing 'use'. A major shortcoming of many definitions of 'use' is their inadequacy in identifying "when an information seeking act begins and ends. For example, does reading

²⁸M. B. Line, "Draft Definitions: Information and Library Needs, Wants, Demands, and Uses," Aslib Proceedings 26 (1974): 87.

²⁹Roberts, p. 310.

³⁰E. R. Morss and R. F. Rich, Government Information Management: A Counter-report of the Commission on Federal Paperwork (Boulder, Col.: Westview Press, 1980).

one book on five separate occasions count as one act or five"¹¹

An attempt was made to categorize types of 'use' and create a typology of use in a pilot study undertaken in March, 1983, in order to define and measure use.¹² Although two main variables were identified--the amount of a book read and the purpose for which it was read--combining these variables to create an index or scale did not lead to a meaningful typology or operational definition.

1.2.1 Meier's Item-Use-Day

One proposal to measure use may be found in the research literature of library effectiveness and utility. In 1961, Meier suggested that a precise measure of use is the 'item-use-day'.¹³ His measurement is based on the total use of a document per day, regardless of the amount, extent, or the purpose of use. He defines use as "whatever a person being served

¹¹J. Blagden, Do We Really Need Libraries? (New York: Clive Bingley, 1980), p. 27.

¹² see Appendix A.

¹³R. L. Meier, "Efficiency Criteria for the Operation of Large Libraries," Library Quarterly 31 (1961): 215-234.

would fairly define as such upon being interviewed and asked such a question as 'how many books did you use yesterday?'" This method has the advantage of unifying the measurement unit regardless of the many variables that are involved. The major disadvantage of utilizing it is its inherent lack of definition of the concept of 'use'. Although Meier provides the above definition, in fact, the user's perception determines what constitutes 'use'. Bookstein, in a study on user surveys, found that less than half of the subjects in an experiment agreed that "skimming a book, reading a small section, and finding the book useful," was in fact a 'use'.¹⁴ He has found many similar examples and warns researchers to consider the type of questions they ask and how these questions may be interpreted by respondents. Meier's definition suffers from the subjectivity of the user's perception. Nevertheless, item-use-day may be utilized as a measuring device to indicate the amount of usage of documents in general.

¹⁴Bookstein, p. 39.

1.2.2 Exposure and Contact Times

Hamburg, in a book on library planning and decision-making systems, proposed document exposure as a basis for performance measurement. He defined direct exposure as the period when an individual seems to be "applying at least one of his senses -- seeing, hearing or touching . . . to a document."¹⁵ Exposure occurs when a user has an open book in front of him/her, regardless of whether he/she is in the library or at home. Hamburg suggests two types of measurement. The first measure consists of counting each circulation, along with in-library use, interlibrary loans etc., as 'one unit of exposure'. One of the disadvantages of this method, he states, occurs when different exposure types are added together:¹⁶

If the same book is circulated for four weeks and even if it is used for much more than five hours, there is still only one exposure... In addition browsing exposures to ten different documents in an hour are not necessarily more beneficial than an hour of in-depth exposure to one document.

The second measure proposed by Hamburg is exposure time. This measure is the amount of time the user spends on each document during the loan period. The

¹⁵Morris Hamburg et al., Library Planning and Decision-Making Systems (Cambridge: The MIT Press, 1974).

¹⁶Ibid., p. 21.

average exposure time for a user may be expressed in number of hours. Hamburg, using a sample of 308 persons, found the average exposure time per circulated document to be 2.25 hours. He used an interview survey method, questioning the patrons on how much time they had spent with each book which they were returning to a public library. Stout found that the "average amount of time spent by the borrower or anyone else" with a circulated document to be 3.22 hours. He interviewed a sample of 887 patrons returning 1414 documents to a public library over a period of 25 working days.¹⁷ Morse has estimated the average exposure time per document to be as high as ten hours.¹⁸ The major weakness of Hamburg's and Stout's studies was the data collection which relied on the patrons' recall and is thus of doubtful reliability.¹⁹ Nevertheless, Hamburg's exposure time measure has to be seriously considered as a viable alternative for defining and quantifying use.

Kantor has suggested a similar measure which he

¹⁷Chester Bernard Stout, "Measurement of Document Exposure Time Distributions at a Small Public Library" (Ph.D. dissertation, Case Western Reserve University, 1976), p. 54.

¹⁸Morse, p. 177.

¹⁹E. R. De Prosop, E. Altman, and K. E. Beasley, Performance Measures for Public Libraries (Rutgers University: American Library Association, 1973), p. 9.

calls Total Contact Time.⁴⁰ He states that two classes of objective measures may be performed in a library setting. Circulation counts is an example of the first class, and time spent reading or consulting is an example of the second class. The measures in the latter class may be more important for performance measures, since "a continued activity represents some (unknown) number of decisions to continue, so that its duration provides some indication of the value of the activity to the user."⁴¹ Furthermore, he states that contact time, or the total amount of time that the library user spends reading the library materials, is the "most nearly precise measure of benefit which he derives."

Kantor defines total contact time, for all readers and all books, as:

$$TCT = \sum_{i \text{ consults } j} t_{ij} + \sum_{i \text{ borrows } j} t_{ij}$$

where t_{ij} is the duration of contact between reader i and book j (consultation is in-library use, and borrowing occurs when a book is charged-out of the library).

To operationalize total contact time, he introduces

⁴⁰P. B. Kantor, "The Library as an Information Utility in the University Context: Evolution and Measurement of Service," Journal of the American Society for Information Science 27(March-April 1976): 105.

⁴¹Ibid., p. 105.

the variable t_b , average contact time during a borrowing (which was reported by Hamburg to be 2.25 hours per circulated document):

$$t_b = \int -y'(T) U(T) dT$$

where T is the borrowing time, $U(T)$ is the average accumulated contact time during loans of time T , $y(T)$ is the probability of a book being held more than T , and $y'(T)$ is the first derivative of $y(T)$. But since $U(T)$ is not easily observable, Kantor proposes to simplify the above equation to:

$$t_b = \sum u(t)$$

where $u(t)$ is the average contact time on the t 'th day of the borrowing and the total mean usage time t_b is then the direct sum of these daily averages. This quantity may be measured by questioning the library users, whose borrowing time is known, on the amount of contact time they have had with the borrowed books during a specific time period.

Kantor further suggests that the distribution $U(T)$ may be independent of T for large values of T , and hence t_b would also be unchanged by the loan period. This postulation is based on a universality which was observed by Buckland and Shaw. Buckland's study shows:⁴²

There is a marked tendency for borrowed books to be returned (or renewed) when they are due

⁴²Buckland, p. 138.

back and that this pattern is strongly marked regardless of the length of the 'official loan period, the status of the borrower or the subject matter of the books borrowed.

Shaw, in several academic libraries with different loan periods, made the following observation:⁴³

Books are returned at a constant, predictable rate from zero to about 80% of the maximum loan period. From 80 to 100% the return rate accelerates under the influence of the due date and the penalty associated with overdue books. . . . These results . . . suggest that the loan period distribution may possess universally consistent characteristics.

If a 'universality' exists, when does the actual contact between the reader and the text occur? What is the shape of contact time distribution $U(T)$? Does contact time distribution possess 'universally consistent characteristics' for all the users and books?

⁴³W. M. Shaw Jr., "Loan Period Distribution in Academic Libraries," Information Processing and Management 12(1976): 159.

CHAPTER II

PURPOSE AND OBJECTIVES

Three methods of measuring 'use' have been identified in the previous chapter: Meier's item-use-day, Hamburg's exposure time, and Kantor's contact time. Although each has its own advantages and limitations, contact time seems to be a more comprehensive method of measurement than either of the other two. Contact time may indicate that the reader is actually finding something of value in the text, or, as Kantor has noted, an assumption may be made that "benefit to a user is proportional to the contact time."¹

The purpose of this study is to determine the extent of book use by undergraduate students from the time the books are checked out of the library system until their return. Specifically, measuring contact time for each book and each student forms the central

¹ Kantor, p. 105.

core of this research. The average contact times per user, per book, and over the loan period, and the shape of the contact time distributions may depend on a number of variables such as the attributes of the borrower, the attributes of the book, and nature of the borrowing or enquiry.

Frank Hatt's framework for reading has been used to identify different variables that may have an effect on the contact times and therefore use of documents. Users or readers are defined as the undergraduate students who are attending the University of Western Ontario and McGill University at the time of the research. They form the single largest group of library users on these campuses, and on many others.² The number of courses the students are currently enrolled in, their year of study, and their major field of study are attributes of students that may affect their book usage.

The books that are borrowed by the students are defined as those documents that have a regular loan period. Excluded from the study are special materials, such as some of the government publications, books on reserve, and serials. 'Loan period' is defined as the number of days for which a book is lent out to the undergraduate students by the academic library. 'Retention time' or 'retention period' is defined as the

²W. E. McGrath, "Multidimensional Mapping of Book Circulation in a University Library," College and Research Libraries 44 (1983): 104.

number of days which the students hold the borrowed books. While loan period is fixed, retention period is variable and may be shorter than, equal to, or longer than the loan period.

The attributes of the borrowed books may be defined in terms of their subject matter and their readability or level of difficulty. The former attribute has been operationalized by using the Library of Congress classification scheme as a broad subject heading. Readability, on the other hand, is difficult to measure. Readability formulas have been shown to be "plagued with a variety of problems raising serious questions to their usefulness."³ Hatt states that "the reading act is a function of both text and reader, the assessment of the readability of texts and the reading performance of readers is a circular process."⁴ Hence, readability may be best assessed by the students in terms of the level of difficulty that they attribute to a document.

The nature of the borrowing (or enquiry, as Hatt refers to it in his framework) is defined in terms of the purpose for which the books are checked out, i.e., borrowed specifically for writing an essay or assignment; classroom reading; preparation for examination; general education; or leisure. Another

³C. R. McConnel, "Readability Formulas as Applied to College Economics Textbooks," Journal of Reading 26(1982): 17.

⁴ Hatt, p. 58.

variable, 'usefulness', may also affect the student's decision as to whether to continue with the same text and hence increase his/her contact time, or seek an alternative source of information. Usefulness, like difficulty, may be best assessed by the students. The reading/study techniques employed by the students may also play a role in the amount of contact time. Miller, comparing four such techniques found that the mean time spent for each study method "differed significantly ($p < 0.05$), with reading only taking the least time

Meier, Hamburg, and Kantor have contributed significantly to the clarification of some of the problems in defining and operationalizing use. However, their methodology and measurements need to be extended beyond their utilization of item-use-day, exposure time, and contact time. Meier's measurement depends on how the readers define use and lacks a precise operational definition. Hamburg's approach may suffer from users' imprecise recall and it, therefore, may be unreliable. Kantor's suggestion on measuring the average contact times at one point during the loan period has not been tested for its validity and reliability.

The main purpose of this research is to utilize the methods which have been outlined by Meier, Hamburg, and

³J. W. Miller, "An Examination of the Efficiency of Four Reading/study Techniques," Journal of Reading 26(1982): 241.

Kantor to describe and measure use of books by undergraduate students in two academic institutions and to relate this use to characteristics of the users and the books. Specifically, the objectives and hypotheses are:

1. To find a mathematical function $V(t)$ which represents the expected value of the cumulated proportion of 'uses' at the t 'th day of the loan period for a random sample of readers and books. 'Uses' are defined as the daily contact times which are greater than zero regardless of their actual values. This measure is similar to Meier's item-use-day, except that it is much more precise, since contact times are utilized to define use.

2. To determine the relationship between use as defined by daily contact times in the previous section and; (a) students' major areas of studies, (b) number of courses in which students are enrolled, (c) students' year of study, (d) subject concentrations of the books, (e) purposes for borrowing the books, (f) subject concentrations of the courses, (g) levels of difficulty of borrowed books, (h) levels of usefulness of the borrowed books.

3. To find a mathematical function $Q(t)$ which represents the expected value of $u_{i,t}$ at time t , where

u_{ijt} is contact time on the t 'th day since book j was borrowed by user i .

4. To find a mathematical function $f(u)$ which represents the frequency distribution of u_{ijt} .

5. To find whether E , the average contact time per user per book obtained from a diachronous or longitudinal sample, can be estimated by E' , the average contact time per user per book obtained from a synchronous or cross-sectional sample, where;

$$E = \frac{\sum_{t=1}^L \sum_{i=1}^m \sum_{j=1}^{n_i} u_{ijt}}{S},$$

$$S = \sum_{i=1}^m n_{i,t}$$

m is the number of users, $n_{i,t}$ is the number of books read by the i th user on the t th day, L is the longest retention time;

$$E' = \frac{\sum_{t=1}^{L'} \sum_{i=1}^{m'} \sum_{j=1}^{n'_{i,t}} u'_{ijt}}{S'}$$

$$S' = \sum_{t=1}^{L'} \sum_{i=1}^{m'} n'_{i,t}$$

u'_{ijt} is the contact time of the j th book which has been

error is fairly substantial."⁹ An earlier study also suggested that the respondents tended to postpone recording in the diaries until they had free time to do so.⁹ However, other research indicates that a combination of diary-interview method would ensure reliability.¹⁰ Zimmerman and Wieder state that if the diarists are interviewed on the subject of their completed diaries, they tend to recall the events which they may not have otherwise mentioned, or correct some of the observations which may seem erroneous.

3. The time span for keeping the diaries should be fairly short. Line suggests four days¹¹ and Zimmerman and Wieder seven days¹² for the recording period. They state that the longer the time span, the less likely that respondents will be cooperative and will be accurate in keeping the diary records. Stewart, on the other hand, used a four week period for her study on managers' behaviour at their jobs.¹³ Her sample,

⁹Line, p. 43.

¹⁰I. H. Hogg, and R. L. Smith, "Information and Literature Use in a Research and Development Organization," Proceedings of the International Conference on Scientific Information (Washington, D.C.: National Academy of Sciences, 1959).

¹¹D. H. Zimmerman, and D. L. Wieder, "The Diary," Urban Life 5 (1977): 479-498.

¹²Line, Library Surveys, p. 44.

¹³Zimmerman, p. 480.

¹⁴R. Stewart, Managers and Their Jobs (Toronto: Macmillan, 1967).

8. To test the following hypotheses for the books: that there is no significant difference in average daily contact times

(a) among books with different subject concentrations;

(b) among books borrowed for different purposes;

(c) among books borrowed for different courses;

(d) among books borrowed with varying levels of difficulty;

(e) among books borrowed with varying levels of usefulness;

(f) among books for which different study techniques are used.

9. To find the relationships among "independent" variables, to discover any patterns which may exist.

CHAPTER III

METHODOLOGY

Two types of data are needed for this exploratory research study: diachronous data to be collected by the diary method and synchronous data to be obtained by telephone interviews.¹

3.1 Diachronous Data and Diary Method

Diachronous refers to data collected longitudinally, or over a period of time. The data necessary for examining the contact time distribution

¹For a theoretical discussion of the terms diachronous and synchronous in relation to use and age of documents, see Maurice B. Line and A. Sandison, "Obsolescence and Changes in the Use of Literature with Time," Journal of Documentation 30 (September 1974): 287.

TABLE 1

POPULATION AND SAMPLE - UWO

UNDERGRADUATE FULL-TIME	POPULATION ¹ 1983-84	SAMPLE March 84	DIFFERENCE %
ARTS	1329 (10.4)	27 (8.8)	-1.6
SOCIAL SCI.	5259 (41.3)	125 (40.6)	-0.7
SCIENCE	3500 (27.5)	90 (29.2)	+1.7
ENGINEERING	993 (7.8)	25 (8.1)	+0.3
MUSIC	465 (3.6)	12 (3.9)	+0.3
PHYS. & OCC.	550 (4.3)	15 (4.9)	+0.6
HEALTH SCI. ²	644 (5.1)	14 (4.5)	-0.6
TOTAL	12740 (100.)	308 (100.)	0.0

FIRST YEAR	3942 (30.9)	76 (24.7)	-6.2
SECOND YEAR	4153 (32.6)	104 (33.8)	+1.2
THIRD YEAR	3519 (27.6)	90 (29.2)	+1.6
FOURTH YEAR	1126 (8.8)	38 (12.3)	+3.5
TOTAL	12740 (99.9) ³	308 (100.)	0.1

¹Excluding special students.

²Excluding dentistry and medicine

³Rounding error

its use:

1. Self-motivated volunteers have to be recruited to record their daily activities in a diary. In order to provide data over a number of days, participants in the study have to be willing to make multiple diary entries. Therefore, the individuals involved may not form a random sample of a population, but be self-selected for qualities of persistence.⁵

One solution for the motivation problem may lie in the provision of some kind of honorarium to recruit a larger sample of the population. BBM provides each respondent with a fifty cents "token of appreciation." They claim a 50% response rate from a diary mail-out method. On the other hand, Harrop has reported a 97% response rate for a group of students who completed three different diaries on the library use, without any honoraria⁷.

2. The second limitation lies in the reliability of the diaries. Line suggests that even if all the individuals are "honest and conscientious, the likely

⁵D. N. Wood, "Discovering the User and his Information Needs," Journal of Documentation 37(1981): 268.

⁶M. B. Line, Library Surveys (London: Clive Bingley, 1967), p. 43.

⁷C. Harrop, "The Information Needs of Undergraduates Projects: Library Use by Some First Year Social Science Students," CRUS News 12 (1981): 6.

error is fairly substantial."⁹ An earlier study also suggested that the respondents tended to postpone recording in the diaries until they had free time to do so.⁹ However, other research indicates that a combination of diary-interview method would ensure reliability.¹⁰ Zimmerman and Wieder state that if the diarists are interviewed on the subject of their completed diaries, they tend to recall the events which they may not have otherwise mentioned, or correct some of the observations which may seem erroneous.

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⁹I. H. Hogg, and R. L. Smith, "Information and Literature Use in a Research and Development Organization," Proceedings of the International Conference on Scientific Information (Washington, D.C.: National Academy of Sciences, 1959).

¹⁰D. H. Zimmerman, and D. L. Wieder, "The Diary," Urban Life 5 (1977): 479-498.

¹¹Line, Library Surveys, p. 44.

¹²Zimmerman, p. 480.

¹³R. Stewart, Managers and Their Jobs (Toronto: Macmillan, 1967).

excluding the non-respondents and unreliable diaries, was 160 persons. Fishendon reported using 63 graduate staff as diary keepers for about two months.¹⁴

Ten first term students at the School of Library and Information Science, University of Western Ontario, participated in a pre-test, using the diary method. As a result of pre-test findings, the format of the diaries was changed (appendix B). Noteworthy are the students' comments on the effects of keeping a diary on their book borrowing and reading habits, a point also mentioned by Martyn and Lancaster.¹⁵

3.2 Synchronous Data and Telephone Interviews

Synchronous refers to data collected cross-sectionally, or at one point in time. In a short telephone interview, the data on how many books the users have had contact with in the past 24 hour period, how long the books have been held on loan, and how long the readers have spent with each book in the previous day are collected. Kantor suggests that a short

¹⁴R. M. Fishendon, "Methods by which Research Workers Find Information," Proceedings of the International Conference on Scientific Information (Washington, D.C.: National Academy of Science, 1959).

¹⁵J. Martyn, and F. W. Lancaster, Investigative Methods in Library and Information Science: An Introduction (Arlington, Va.: Information Resources Press, 1981).

telephone interview (60 seconds) would reveal the average contact time $u(t)$ in a 24 hour period.¹⁶

Telephone interviews can be "an extremely efficient survey method."¹⁷ The response rate is generally very high, and the method on the whole is inexpensive. One of the disadvantages of the telephone survey is that the duration of the interview should be fairly short. However, to satisfy the objectives of this research, the interviews need not last more than a few minutes, and hence the time limitation does not pose any problems.

¹⁶Kantor, p. 111.

¹⁷J. L. Simon, Basic Research Methods in Social Science (New York: Random House, 1978), p. 197.

3.3 Data Collection

3.3.1 Population -- The University of Western Ontario

The University of Western Ontario (UWO) was founded in 1878. It became non-denominational in 1908 and opened one of the first French immersion programs in 1933. UWO has grown steadily since Second World War. In the 1983-84 academic year, UWO had an enrollment of 20,056 full-time (18,179 undergraduates) and 6,504 part-time (5,807 undergraduates) students.

An analysis of the percentage distribution of enrollment by age of the full-time undergraduates indicates that 92% of this population is 25 years of age or younger, indicating a relatively young student body.¹⁸ The library system was ranked 60 out of 101 by the Association of Research Libraries library index in 1980-81.¹⁹ It consists of eight libraries, the largest of which is the D.B.Weldon. The system employed 299 staff in 1983-84, 55 of whom were professionals. The total library budget for that year was \$9,965,605 and the number of volumes held was 1,433,751. The UWO

¹⁸The University of Western Ontario, Mini-facts (London, Ont.: Dept. of Information Analysis and Systems, 1984).

¹⁹Association of Research Libraries; ARL Statistics, 1980-81 (Washington, D.C.: Association of Research Libraries, 1981).

library system is automated and uses Geac model 8000 computers.

The loan period for the major part of the library collection at UWO is four weeks long with the possibility of renewals.

The major faculties with undergraduate degree programs at UWO are: arts, education, engineering, law, music, nursing, physical education, science, and social science.

3.3.2 Sample -- The University of Western Ontario

In February 1984, 20 volunteers were recruited from a research methods course at the School of Library and Information Science, UWO to interview undergraduate students. The subjects were chosen through a random sample of 20 pages from the University Community Centre Telephone Directory. The directory consists of the names of the students, their status, and their field of study. Each name on a page was numbered, excluding the graduate students, interns, and those disciplines not in the population frame work. Fifty numbers corresponding to student names were chosen at random from each page. It was decided that volunteers did not have sufficient time to contact more than fifty undergraduate students

by telephone. Therefore a total of one thousand names and phone numbers were supplied to the interviewers who contacted the undergraduate students during the period of March 8 to 16, 1984. In a two-hour session, the volunteers were instructed on how to conduct a telephone interview, when to contact the students, and how to record the data. Although a few volunteers had had some survey experience, the majority were first-time interviewers. A schedule was handed out (Appendix C) outlining the procedure to be followed by the volunteers.

Out of one thousand, 406 students (40.6%) were contacted by telephone. The remaining were divided among the following categories: wrong number; disconnected numbers; long distance; withdrawals from the university; not home or busy signal on each of three attempts.

Of 406 students contacted, 8 (2.0%) refused to be interviewed mainly due to time constraints, 228 (56.2%) had not checked out any library books, 146 (36%) had library books, and 24 cases (5.9%) were not properly reported.

Once the interview schedules were collected, the data were tabulated on individual sheets for each interviewer. A main problem encountered was the recording of non-existent call numbers for the borrowed books. Almost all the entries had to be checked using

the Geac System which had been recently installed at UWO libraries. Once the call numbers were verified, the due dates had to be checked for each individual book. This latter problem arose because some interviewers had recorded due dates while others had written the check-out dates on the interview schedules. In all, over 400 books had to be examined for call numbers and due dates to ensure accuracy in data. As a result, 24 mentioned cases had to be deleted from the database with an additional 18 cases having "bad" or "missing" fields, i.e., student's major area of study, year of study, subject of the borrowed book, or contact time had not been recorded properly.

Table 1 shows the final results of the sampling in comparison with the actual population. For the purposes of juxtaposition, only the statistics for the full-time students in major disciplines are used. The largest difference between the sample and the population is only 1.7% which should not lead to any biases.

As this table also indicates, the first year students are under represented. One possible explanation is that some full time undergraduate students, specifically the freshmen in first year, live in the university residence, boarding houses, or shared accommodations with no telephone listings and hence could not be reached.

On the other hand, some students who have been

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ENGINEERING	993 (7.8)	25 (8.1)	+0.3
MUSIC	465 (3.6)	12 (3.9)	+0.3
PHYS. & OCC.	550 (4.3)	15 (4.9)	+0.6
HEALTH SCI. ²	644 (5.1)	14 (4.5)	-0.6
TOTAL	12740 (100.)	308 (100.)	0.0

FIRST YEAR	3942 (30.9)	76 (24.7)	-6.2
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¹Excluding special students.

²Excluding dentistry and medicine

³Bounding error

attending the undergraduate program part-time and have changed their status to full-time may account for the over-representation in the fourth year category. These students, when asked about their "year of study," might have given the actual number of years of attendance, which would inflate the last category.

3.3.3 Population -- McGill University

McGill University was founded in 1821. In 1829 the Montreal Medical Institution became the new university's Faculty of Medicine. In 1852 the Royal Institution for the Advancement of Learning merged with McGill University. After World War I, McGill and University of Toronto began the development of postgraduate studies in Canada. Since then McGill University has grown steadily while maintaining its reputation as a world renowned research institution.

In the fall term 1984-85 academic year, 29,300 day and evening students had enrolled in various disciplines at McGill. Total number of undergraduates during the same period was 13,417. In 1980-81, the Library system was ranked 47 out of 101 by the ARL Library Index.²⁰ The library system encompasses 22 libraries grouped by

²⁰ Ibid.

subject into five administrative areas: Humanities and Social Sciences, Law, Life Sciences, Physical Sciences and Engineering, and Undergraduate. The Library system employs 316 staff of whom 73 are professionals. The total budget for 1984-85 academic year was \$11,833,267, with total holdings of 1,664,417 volumes. The major part of the McGill collection has a loan period of two weeks for the undergraduate students with the possibility of renewals.

The major faculties with undergraduate degrees at McGill are: arts, science, management, education, music, engineering, law, religious studies, and agriculture. The Faculty of Arts covers a wide variety of disciplines including economics, political science, and sociology which in some other academic institutions are part of the faculty of social science.

3.3.4 Sample -- McGill University

In October 1984, three MLS graduates were hired on a contract basis to carry out a telephone survey. The Registrar's Office agreed to provide a sample of undergraduate students who had given their permission for the release of their telephone numbers. The Office estimated that about half of the student population normally signs a special telephone number release form.

It was also suggested that no established patterns in obtaining permission from the students existed, i.e., it is not dependent on any particular factor or confined to a specific discipline. The Registrar's Office provided a systematic random sample of 602 undergraduate names in pre-specified disciplines, along with their phone numbers. The computer print-out containing the list was divided among the three interviewers. One interviewer had had previous telephone survey experience. All interviewers were provided with specific instructions about conducting the interviews.

The interviews took place during the period of November 5 to November 18, 1984. Out of 602 listed names, 91 (15.1%) did not have any telephone listings, 144 (23.9%) could not be reached due to wrong numbers, disconnected numbers, withdrawal from McGill, away from home, or failure after three attempts. Of the remaining numbers, only one person refused to be interviewed, 111 (30.2%) had checked out books, 244 (66.5%) had no library books, and 11 cases (3%) were not properly reported or lacked sufficient information to be included. Since the interviewers were MLS graduates with some library related experience, the number of problems encountered in tabulating and coding the data were reduced considerably.

Table 2 shows the final results of the sampling in comparison with the actual population. For the purposes

TABLE 2

POPULATION AND SAMPLE - MCGILL

UNDERGRADUATE FULL-TIME	POPULATION ¹ FALL 84	SAMPLE November	DIFF. %
ARTS & MANAGEMENT	5917 (57.0)	167 (52.4)	-4.6
SCIENCE	2192 (21.1)	47 (21.0)	-0.1
ENGINEERING	1569 (15.1)	48 (15.0)	-0.1
MUSIC	313 (3.0)	21 (6.6)	+3.6
PHYSIC. & OCCUP.	388 (3.7)	16 (5.0)	+1.3
TOTAL	10379 (99.9) ²	319 (100.)	0.1

FIRST YEAR	2349 (32.3)	102 (32.0)	-0.3
SECOND YEAR	3956 (38.1)	115 (36.0)	-2.1
THIRD YEAR	3034 (29.2)	89 (27.9)	-1.3
FOURTH YEAR	40 (0.4)	13 (4.1)	+3.7
TOTAL	10379 (100.)	319 (100.)	0.0

¹Excluding special students

²Rounding error

of comparison, only full-time enrollment figures in major disciplines are used. The largest difference between the sample and the population is 4.6% in the area of arts and management.

Analogous to UWO results, the fourth year is over-represented, possibly due to the nature of the question, which does not differentiate between number of years in the university and year of study.

3.3.5 Diaries

In early October 1984, an advertisement campaign was started at McGill to recruit volunteers to keep diaries of their reading times of books borrowed from the university library system. Posters were placed on the bulletin boards, leaflets were distributed around the campus, and advertisements were placed in the students' newspapers. The notices contained information about the rewards for the volunteers as well as dates, times, and meeting places. Five days were chosen from October 22 to 26, to meet with the students. Five students, 2 English and 3 psychology majors responded to the recruitment campaign. Considering the amount of time spent on the advertising, the response rate was minimal and upon consultation with the advisory committee it was decided to approach the problem

differently.

In January 1985, various professors were approached to request their permission for recruiting volunteers from their classes. Finally, Professor Smith of the Sociology department agreed to ask his class, Sociological Inquiry, to participate in the research. A formal presentation on the purpose of the research and what the volunteers had to do was made to the class. As an added incentive, Professor Smith agreed to devote one percentage of the final grade to participants in the project. In all, 52 students signed up their names to volunteer. Of this number 18 (34.6%) did not take out any library book during the time frame of the study, from February to April; 23 (44.2%) returned their completed diaries; and 11 (21.2%) did not participate (Table 3).

TABLE 3

VOLUNTEERS FOR DIARY KEEPING

MAJOR FIELD OF STUDY		
SOCIOLOGY	32	(78.1)
POLITICAL SCI.	3	(7.3)
INDUSTRIAL REL.	3	(7.3)
ART HISTORY	1	(2.4)
BIOLOGY	1	(2.4)
NURSING	1	(2.4)
TOTAL	41	(99.9)*

YEAR		
FIRST	24	(58.5)
SECOND	11	(26.8)
THIRD	6	(14.7)
TOTAL	41	(100.)

*Rounding error

CHAPTER IV

DATA ANALYSIS

All the data were coded and input into several files on a microcomputer. A database management system, in conjunction with MINITAB and SAS statistical packages on an IBM mainframe were used for data manipulation. The Library of Congress classification scheme was used to classify and code students' major, the subject of books they borrowed, and the courses they were enrolled in. Hence, a standard and uniform coding scheme was used for comparative analysis and measures of association. Since the amount of data available for analyses were limited, the subject of the books and courses, and students' disciplines were coded into two or three major categories or concentrations. In the case of UWO, all the data was divided into Arts, Social science, and Science. For McGill, students' subject areas were coded as Arts and Science, since there is no

social science faculty. However, for the subject of the books, the McGill data were divided into similar categories as the UWO's. As for the courses, two sets of data were created; the first set contains a coding scheme similar to the subject of the books, i.e., three concentrations, while the second set consists of only two concentrations.

Five major files were created; UWO borrowers and non-borrowers, McGill borrowers and non-borrowers, and the diarists. All the hypotheses tests and tests of association and correlation are calculated at 0.05 significance level.

4.1 Distributions

4.1.1 Number of Book Uses

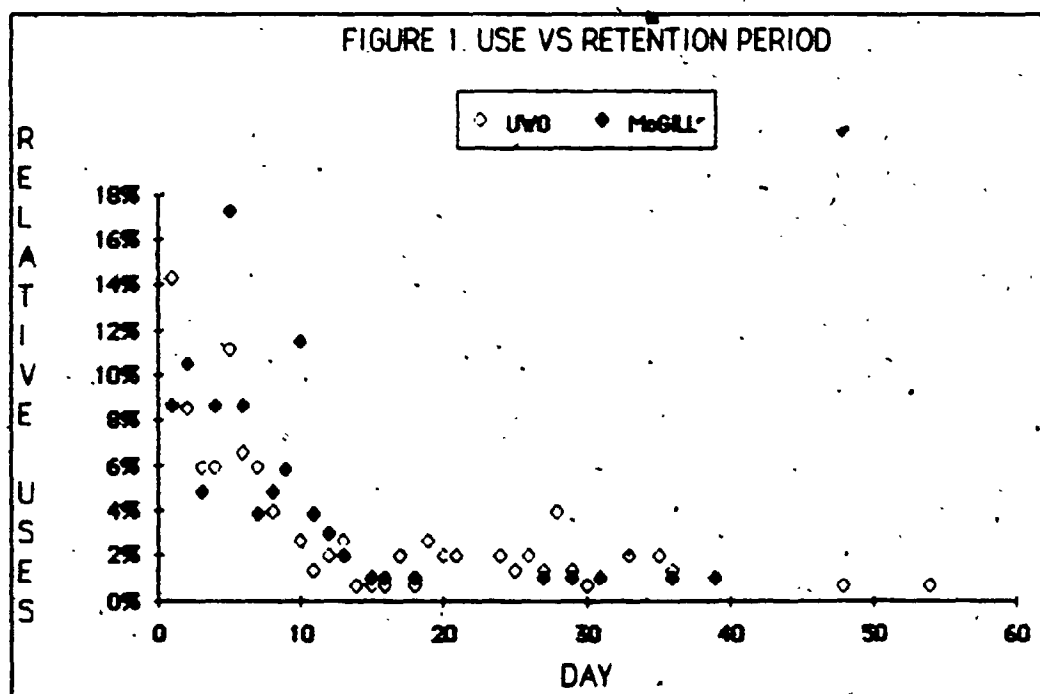
One method to measure the use of books is by counting the number of days with non-zero contact times. This count is equivalent to Meier's item-use-day and indicates the uses made of the borrowed books by the undergraduate students.

The absolute, relative, and cumulative frequencies of the book uses are shown in Tables 4 through 6 (Appendix D) for UWO, McGill and the diary data. The

total number of non-zero contact times for books were 30% and 41% of the synchronous sample for McGill and UWO respectively. Figure 1 is a plot of relative frequencies of book uses versus retention time. The greatest number of uses occurred within the first week of borrowing. In fact, the telephone interviews for UWO and McGill indicate that 58% and 62% respectively of all the uses occurred within the first week of borrowing. In the second week of borrowing, a marked difference emerges between the two groups. While McGill students' uses is 31% of the total amount of uses, UWO students' uses is only 13%. This difference is reasonable, since the former institution's official loan period is 2 weeks while the latter's is 4 weeks. In fact, about 92% of all the uses for both institutions occur within the official loan period while the remaining 8% occur after this time.

These figures differ from the diary data which shows that 76% of the uses occur within the first week, and 12% occur within the second week of borrowing. Nevertheless the actual differences for the overall loan period are remarkably small among all the three data sets, with the diary data showing 87% of the uses taking place within the official loan period.

In order to find a mathematical function and to determine a pattern for the use frequency distribution over loan period, the cumulative relative frequency data



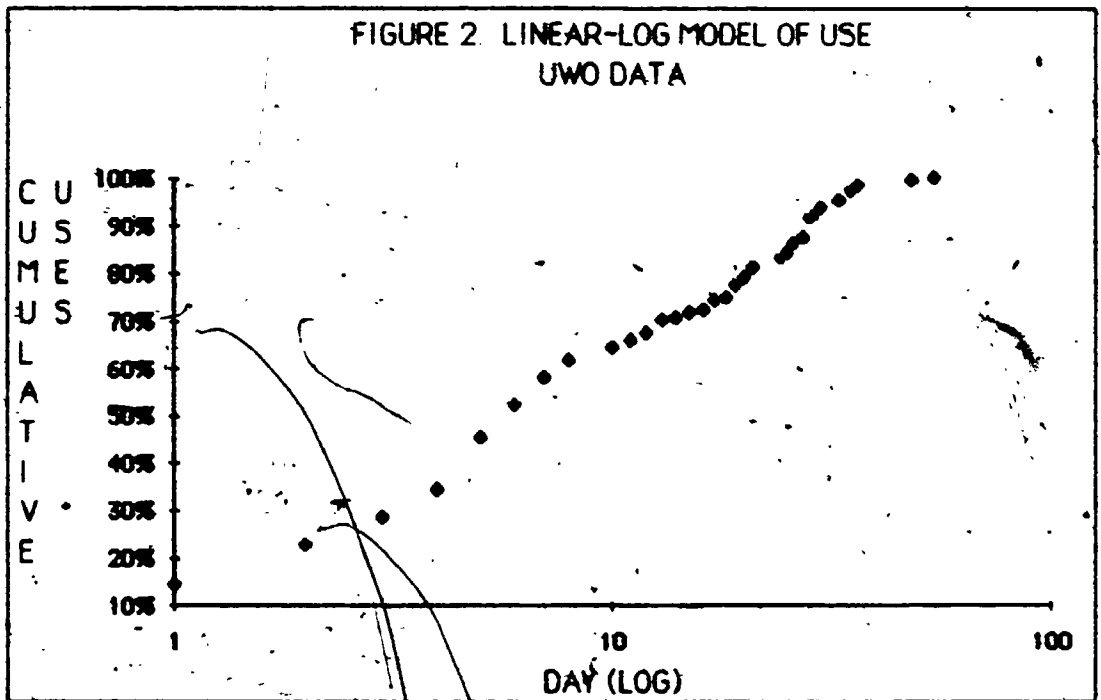
are utilized. Table 7 shows the R^2 values for different models which illustrate the relationship between book uses and retention period.

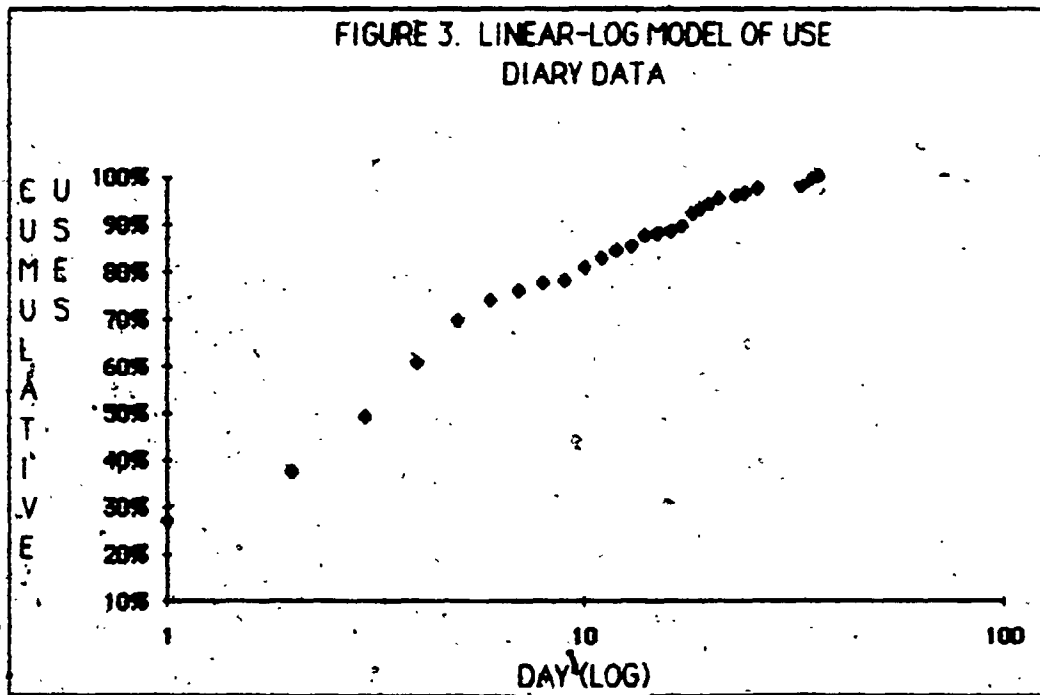
TABLE 7
 R^2 VALUES FOR CUMULATIVE USE MODELS

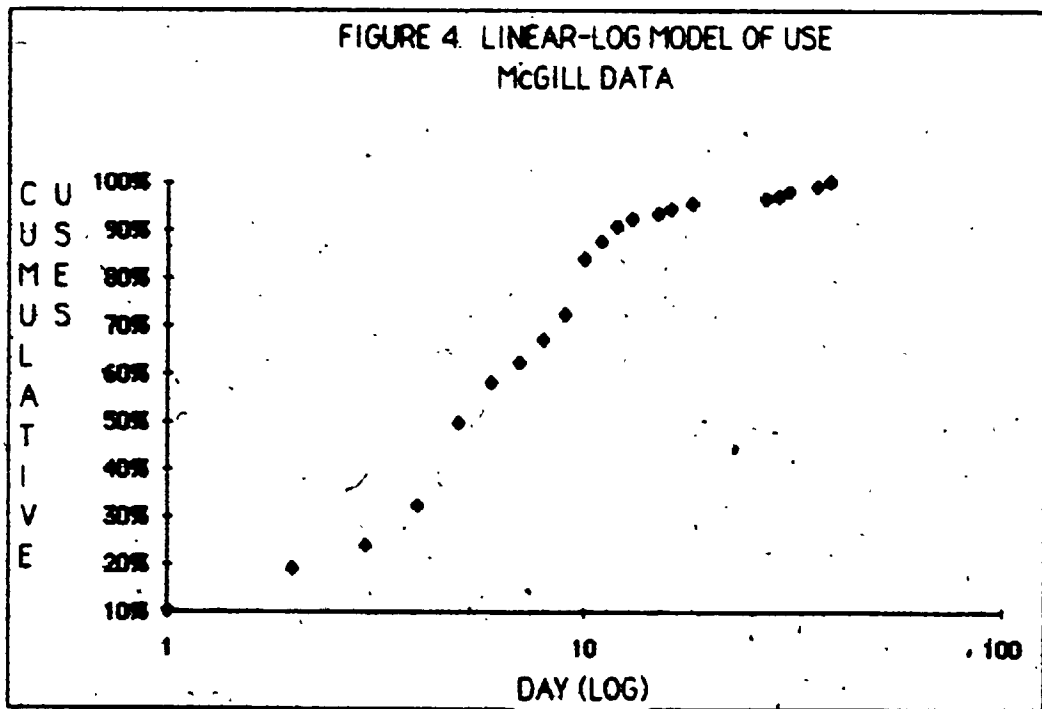
MODEL	UWO	McGILL	DIARY
$V(t) = a + b (t)$	0.780	0.593	0.668
$V(t) = a + b (t)^{1/2}$	0.925	0.769	0.832
$V(t) = a + b \log(t)$	0.982	0.910	0.969

The linear-log model; $V(t) = a + b \log(t)$, where a and b are coefficients and t is number of days retained, seems to be the best model fitting all the data sets. The use pattern may be described as similar to a Bradford-type distribution with an observed initial value higher than the theoretical value, and a "droop" in the right-hand of the curve (Figures 2 to 4). Since retention time is not a ranked variable, a strict application and interpretation of Bradford law is neither valid nor reliable.

FIGURE 2. LINEAR-LOG MODEL OF USE
UWO DATA







4.1.2 Book uses and non-uses

In section 4.1.1 a pattern is established for book use as defined by a count of non-zero contact times. In this section, several hypotheses are tested to determine the relationship between book use and other independent variables. The null hypotheses which have been tested are: there are no significant differences in book use among

(a) students in different major concentrations. The calculated Chi-square value is less than the critical Chi-square value for UWO as well as McGill and therefore the null hypothesis cannot be rejected (Table 8, Appendix D).

(b) students with different number of courses. The calculated value of Chi-square for both institutions is less than the critical value. The null hypothesis cannot be rejected (Table 9, Appendix D).

(c) students in different years of study. Although the calculated Chi-square for McGill is greater than UWO's, both figures are less than the critical value of Chi-square, and hence the null hypothesis cannot be rejected (Table 10, Appendix D).

(d) books in different subject concentrations. Calculated Chi-squares for both institutions are less than critical Chi-squares. The null hypothesis cannot be rejected (Table 11, Appendix D).

(e) purposes for borrowing books. Purpose is categorized as borrowing a book for written assignments and otherwise. The Chi-square analysis shows that the null hypothesis cannot be rejected (Table 12, Appendix D).

(f) courses in different subject concentrations. Chi-square analyses in both cases show that the null hypothesis cannot be rejected (Table 13, Appendix D).

(g) levels of difficulty attributed to the borrowed books by the students. Difficulty was judged on a five point scale from least to most difficult. Chi-square results indicate that the null hypothesis cannot be rejected for McGill and UWO (Table 14, Appendix D).

(h) levels of usefulness attributed to the borrowed books by the students. Usefulness was judged on a four point scale from most useful to least useful. Calculated Chi-square value for McGill university exceeds the critical value of Chi-square and therefore the null hypothesis is rejected (Table 15, Appendix D). For UWO data the result is inconclusive.

In general, the use of books borrowed by the undergraduate students is not dependent on students' attributes as defined in this research or on the attributes of the books. The only dependency which could be detected was between use and the measure of how useful the students found the borrowed books.

4.1.3 Distribution of Contact
Time over Loan Period

Another objective of this study was to determine the distribution of contact times over loan period. Data were collected in the telephone surveys at UWO and McGill during a two to three week period. The amount of time each student had spent with a particular book during the preceding 24 hours was recorded. The relatively large sample sizes for both institutions made it possible to construct profiles of non-zero contact times for each day of the retention time. However cumulation of these times per day does not lend itself to a meaningful representation of contact time distributions, since random sampling was not carried out based on the loan period. Hence, an average time has been calculated for each day of the loan period with a 90% confidence interval.

The diary data has also been treated with the same procedure. The contact times have been averaged for each day of the loan period. A 90% confidence interval for each average has been calculated, even though the diary data do not constitute a random sample. Tables 16 to 18 (Appendix E) show the lower and upper limits for the average contact times for each data set. The contact times are averaged for more than two observations, and a few observations which appeared to

be inconsistent with the remaining data have been excluded from the calculations (see section 4.3).

As Figure 5 indicates, the average times are randomly dispersed over loan period with no patterns emerging. The confidence intervals are very wide for some observations, especially in the latter part of the loan period, due to insufficient number of observations.

Table 19 shows the coefficients a and b in the linear equation $Q(t) = a + b(t)$, where $Q(t)$ is the average contact time per book per user on day t. The Student T statistics indicate that, except for the McGill data set, the remaining data may be considered stationary. There is no significant increase or decrease in average contact times over loan period. Rather it fluctuates randomly around a mean which is about 50 minutes for the diary data and 75 minutes for the UWO data. The McGill data set shows an increase from approximately 30 minutes of contact time on the first day of the loan period to about 90 minutes on the twelfth day, with an average of 61 minutes. It should be noted that McGill data covers only the first 12 days of the retention-time. Hence, it is possible that over a long retention period McGill data shows a similar pattern to the UWO and diary data sets.

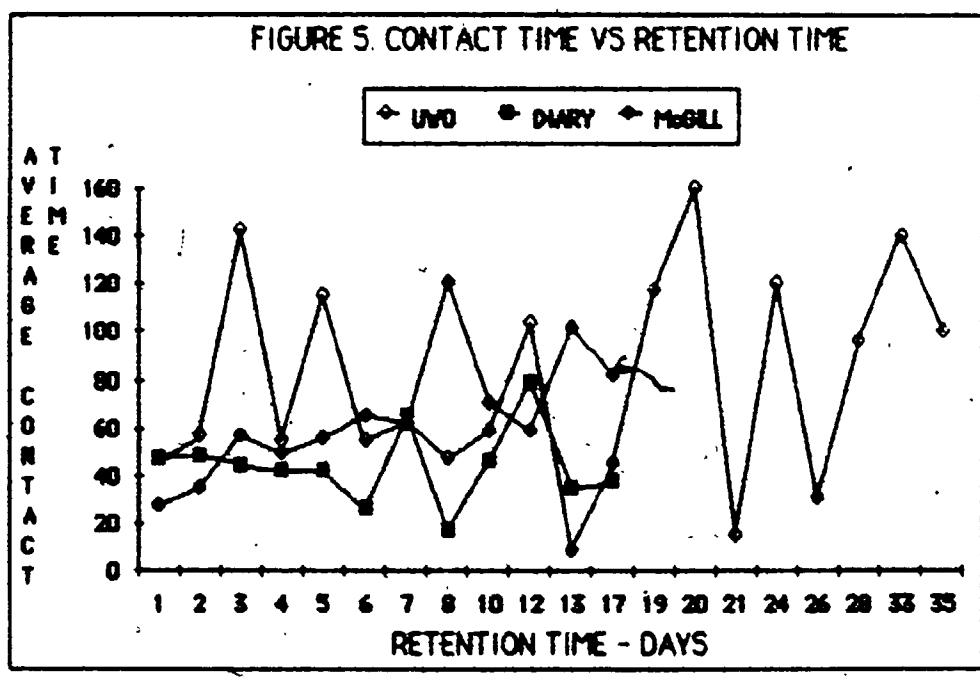


TABLE 19
 COEFFICIENTS AND T STATISTICS FOR AVERAGE CONTACT TIMES

	a	b	T	d.f.	
UWO	59.1	1.22	1.33	18	PROB > 0.05
McGILL	30.9	5.25	3.35	10	PROB < 0.05
DIARY	44.7	0.09	0.09	10	PROB > 0.05

$Q(t) = a + b(t)$
 a = Y intercept
 b = slope
 T = Student T statistics for the slope

4.1.4 Frequency Distribution of Total Contact Time

The data from the diaries carry much more information about the time students spend reading/browsing borrowed library books than do the synchronous data from the telephone interviews. While the latter is only indicative of contact times over a twenty-four hour period, diaries can provide information about the entire loan period. The summation of times for each book in the diary data set provides a clue

about the extent of its use during the retention time. Two sets of data are produced; the first set is for the entire retention time, a period which extends to 36 days; the second set covers the official loan period of 14 days.

Since the data are based on time, the distributions are considered to be continuous. It was hypothesized that the contact time distribution belongs to gamma family, because this family of distributions can be used as a model for many continuous variables¹, particularly variables representing time. In order to test this hypothesis, the mean (\bar{x}) and the standard deviation (s) of the data sets were used to estimate the shape and the scale parameters, ALPHA and BETA², where

$$a = (\bar{x}/s)^2, \text{ and } b = s^2/\bar{x}$$

for a two parameter gamma distribution:

$$f(u; a, b) = \frac{u^{a-1} e^{-(u/b)}}{b^a \Gamma(a)}$$

for $u > 0$

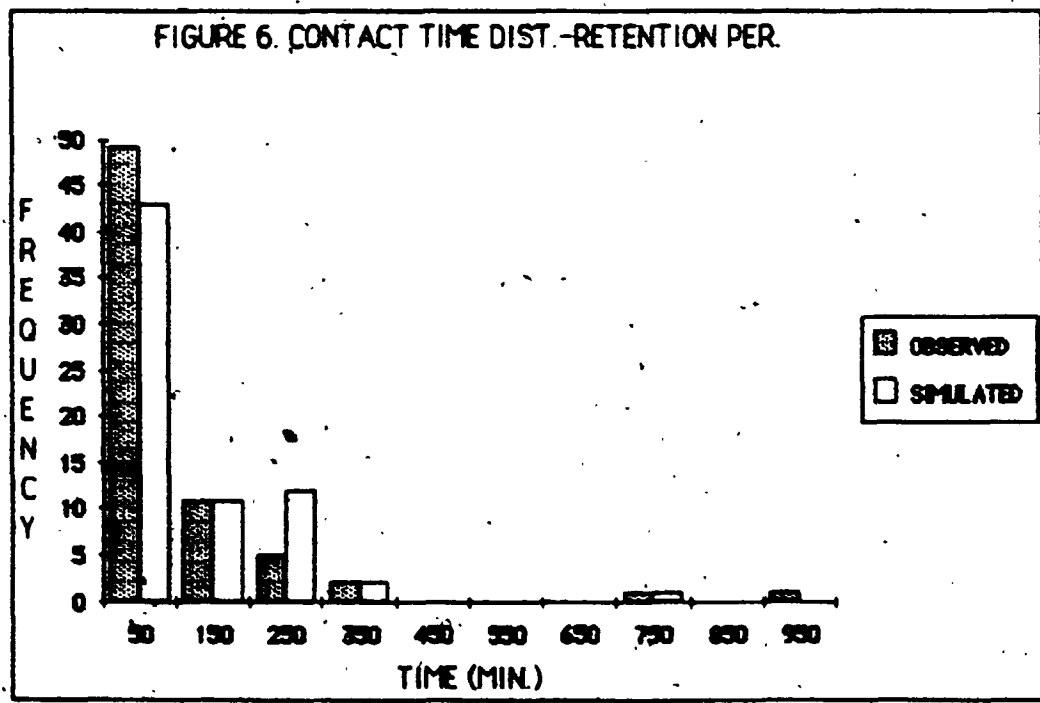
¹Peter W. Zehna, Probability Distributions and Statistics (Boston: Allyn and Bacon, Inc., 1970), p. 148.

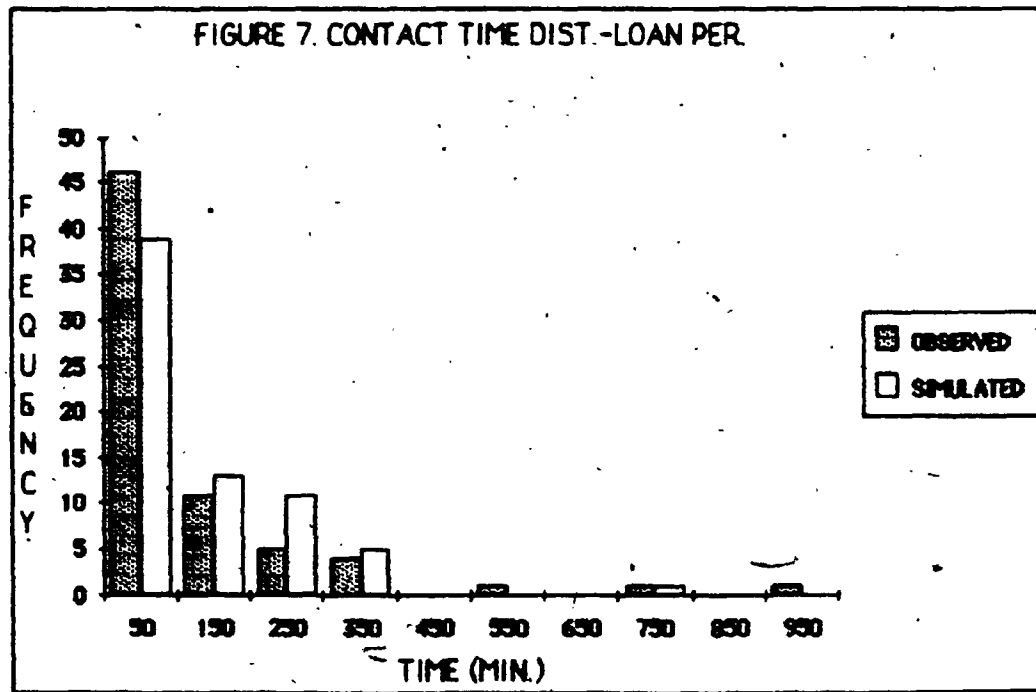
²ALPHA and BETA are represented by the letters a and b respectively.

Using SAS³, random numbers were generated from two gamma distributions to produce a simulated set of contact times for both the retention period and loan period. The use of simulation was logistically more feasible than calculating probability values from partial gamma tables. Figures 6 and 7 show the observed and the simulated data based on the theoretical distributions. Since these are continuous data, a Kolmogorov test of goodness-of-fit was used to determine whether the observed contact time frequencies depart significantly from the theoretical gamma distributions.

In order to carry out the goodness-of-fit test, the relative cumulative frequencies for observed and theoretical data were calculated. The largest difference between the two forms the basis for acceptance or rejection of the null hypothesis, H_0 , that there is no significant difference between the observed and the theoretical distributions. At 0.05 significance level, the critical value of D , the largest deviation, is 0.164, which is larger than the calculated values of D , 0.11 and 0.09 for the retention time and the official loan period respectively. Hence, the total contact times for the borrowed books as reported by the undergraduate students in their diaries fit a double parameter gamma distribution. Since the parameters are

³SAS Institute Inc., SUGI Supplemental Library User's Guide, 1983 Edition (Cary, NC: SAS Institute Inc., 1983), pp. 230-231.





based on the average and standard deviation, the exact shape of the distribution may change from one sample to another.

It is noteworthy that the gamma distribution is related to the Erlang family of distributions through ALPHA and BETA:

$$a = k,$$

$$b = \frac{1}{km}$$

where k is any positive integer and m is any positive constant, constituting the parameters in the Erlang probability distribution,⁴

$$f(u) = \frac{(km)^k u^{k-1} e^{-km u}}{(k-1)!}$$

$$\text{for } u > 0$$

The Erlang distribution is used in queuing analyses where only one person (or object) at a time is in the 'service mechanism'. This situation is similar to book use by a student, where one book can be used by one student at one time. However, further research is needed to establish any relationship between queuing theory and book use and contact times.

One of the characteristics of the double parameter

⁴Donald Gross, and Carl M. Harris, Fundamentals of Queueing Theory, 2d ed. (Toronto: John Wiley & Sons, 1985), pp. 170-171.

gamma distribution is its skewed shape, mainly to the right, with long tails. Essentially, in such a situation, means are skewed in favour of the few extreme values and hence medians might be a better measure of the central tendency.

The most extreme value of the total contact time of a single book in the diary data is 930 minutes. This time is recorded by a first year student majoring in sociology and enrolled in four courses. The book deals with the subject of sociology and it was borrowed for a written assignment for a course in the same field. The student found the book 'very useful', but failed to record its level of difficulty as asked for in the diary schedule. The book was borrowed on March 12 and returned on March 22, 1985. The contact times occurred on the first (180 minutes), second (210 minutes), third (60 minutes), fourth (120 minutes), fifth (90 minutes), sixth (120 minutes), and seventh (150 minutes) days of the retention time. During this time the student read or browsed a total of 308 pages while taking notes, for an average of approximately three minutes per page.

The second largest value recorded in the diaries is 700 minutes. The student who recorded this time is a sociology major in his/her third year of study and enrolled in four courses. The student borrowed a social science book for 'classroom reading' for a course in 'sociological inquiry'. The book was borrowed from

February 20 to March 6, and was found 'easy' and 'very useful'. The contact times occurred on the first (180 minutes), second (300 minutes), sixth (10 minutes), and the thirteenth (210 minutes) day of the retention time. A total of 450 pages were read/browsed with 'detailed notes' taken for an average of 1.6 minutes per page.

Whether these cases are typical of the extreme values of contact times for books borrowed by the students may be the subject of further investigations. However, it is noteworthy that these times occurred within the official loan period of two weeks. In fact, 90% of the books borrowed by the diarists had recorded contact times within the 14 days official loan period.

To explore further the contact time frequency distribution, the synchronous daily contact times from UWO and McGill were used. The averages and standard deviations were utilized to calculate the ALPHA and BETA parameters for a hypothesized gamma distribution. Using SAS, random numbers were generated from two gamma distributions to produce a simulated set of contact times for UWO and McGill. Calculated D values which are less than the critical values, indicate that the daily contact times per user per book also belong to the gamma family for both universities. Table 20 shows a comparison among the UWO, McGill, and diary data.

TABLE 20
 MAXIMUM DEVIATION VALUES FROM GAMMA DISTRIBUTION
 FOR DAILY CONTACT TIMES

	UWO	McGILL	DIARIES
ALPHA	1.0612	1.2978	0.9109
BETA	70.9124	47.4304	55.2968
CAL. D	0.037	0.102	0.074
CRIT. D @ 0.05 SIGNIF.	0.108	0.132	0.106

The shape parameter ALPHA is fairly consistent among all the data sets, while the scale parameter BETA is different for each set. Generally, the overall shape of the contact time frequency distribution $f(u)$ may be considered to be the same for all the data, with the tail ends of the distributions differing from one situation to the next.

4.2 Comparing Diachronous and Synchronous Data

The fifth objective of this research is to determine whether E, the average daily contact time per user per

book obtained from a diachronous or longitudinal sample, can be estimated by E' , the average daily contact time per user per book obtained from a synchronous or cross-sectional sample, where;

$$E = \frac{L}{\sum_{t=1}^L} \frac{m}{\sum_{i=1}^m} \frac{n_{i,t}}{\sum_{j=1}^{n_{i,t}} u_{i,j,t}} / S,$$

$$S = \sum_{i=1}^m n_{i,t},$$

m is the number of users, $n_{i,t}$ is the number of books read by the i th user on the t th day, L is the longest retention time;

$$E' = \frac{L'}{\sum_{t=1}^{L'}} \frac{m'}{\sum_{i=1}^{m'}} \frac{n'_{i,t}}{\sum_{j=1}^{n'_{i,t}} u'_{i,j,t}} / S',$$

$$S' = \sum_{t=1}^{L'} \sum_{i=1}^{m'} n'_{i,t},$$

$u'_{i,j,t}$ is the contact time of the j th book which has been on loan for t days by the i th user, m' is the number of users with books on loan t days, $n'_{i,t}$ is the number of books of user i which have been on loan t days, L' is the longest retention time.

Table 21 shows that the calculated values of E and E' for McGill are only 11 minutes apart. Considering

that the diary sample may not be a representative random sample of the McGill undergraduate student population, the difference between E and E' is small. This similarity indicates that the average contact time from a diachronous sample may be approximately estimated from a synchronous sample. One of the factors contributing to the small discrepancy between E and E' might be over-estimation of the contact times by the students in the synchronous sample.

Since the value of E is averaged over retention period, it is possible to determine the average total value of contact time for the entire retention time. The average total contact time, which is designated as TE is calculated and the value of 131.11 is obtained.

TABLE 21
CALCULATED VALUES OF E , E' , AND TE FOR
THE UWO, MCGILL, AND DIARY DATA

		MEDIAN	MODE	S.D.
Diary	$E = 50.372$	30	30	52.77
Diary	$TE = 131.11$	85	120	162.43
McGill	$E' = 61.557$	45	30, 60	54.03
UWO	$E' = 75.252$	60	60	73.05

TE corresponds to Humberg's exposure time which he found to be 2.25 hours or 135 minutes. This means that the average total contact time per user per book is about two times that of the average daily contact time per user per book for the McGill data.

Many different factors have to be considered in making a comparison between diachronous and synchronous data: (a) the "Hawthorne effect", or behaviour modification of the diarists, which tends to increase their recorded times; and (b) the fact that the majority of the diarists were from social sciences and in their first year of study.

If a valid and reliable comparison can be made, then it may be concluded that students at McGill on the average spend about one hour per day with the borrowed library books, but that their total reading is limited to about two days in the entire loan period, since the average total contact time is 131 minutes.

A conclusion may be drawn for the retention time, since it is found that very little difference exists between the values of E for the official loan period and the maximum retention time by the diarists. A similar pattern exists for the values of E' for both UWO and McGill. In fact, the differences in the average times between the official loan period and the longest retention time by the readers, in all the cases, are less than 2 minutes.

4.3 Outliers

In general an outlier is "an observation (or subset of observations) which appears to be inconsistent with the remainder of that set of data."³

The range of the data for UWO, McGill, and the diaries are such that, if the normal distribution had been assumed, many cases would have to be discarded as outliers. Evidence provided in section 4.1.3 suggests that the contact time distributions belong to the gamma family. Hence, discordancy tests of outliers based on;

$$x_{(n)} / \sum x_i$$

where $x_{(n)}$ is an upper outlier, were conducted.⁴ The results (Table 22) show that, at 0.05 critical region, the upper values of the daily contact times are within the norm, i.e., they are not outliers. On the other hand, had a normal distribution been assumed, the maximum daily contact times within the 95% region, should not have exceeded 218 minutes, 167 minutes, and 154 minutes for UWO, McGill, and diary data respectively. The exclusion of contact times above these maximum values would have resulted in disregarding a total of 23 cases from all the data sets.

³ Vic Barnett, and Toby Lewis, Outliers in statistical data (Toronto: John Wiley & Sons, 1978), p. 4.

⁴ Ibid, p. 78.

TABLE 22
 TEST FOR A SINGLE UPPER OUTLIER IN
 GAMMA AND NORMAL DISTRIBUTIONS

	UWO	McGILL	DIARIES
MEAN	75.252	61.557	50.372
MEDIAN	60	45	30
MODE	60	(30 60)	30
S.D.	73.050	54.034	52.777
N	159	106	164
ALPHA	1.061	1.298	0.911
OBSERVED			
X(r)	360	300	300
GAMMA			
X(r)	717	343	496
NORMAL			
X(r)	218	167	154

X(r) = MAXIMUM

4.4 Tests of Hypotheses

The contact time distributions deal with the average daily and total contact times regardless of who the readers are and the subjects of the books. To gain a better understanding of the use in terms of contact time and to examine the effects of various variables upon it, the data are analyzed in two ways: (1) from the readers' point of view, and (2) from the books' point of view.

Due to the nature of contact time frequency distributions, two sets of analyses were carried out for each test of hypothesis. One is based on the means and standard deviations, such as the analysis of variance, while the second test is based on medians or ranks. In those cases where the results of the two sets of analysis do not match, the results of the more valid and reliable procedure is accepted.

4.4.1 Readers

Students have certain attributes which have been recorded, mainly, their major field of study, number of courses in which they are enrolled, and their year of study. In addition, the date on which each undergraduate student was interviewed was also recorded.

Since each reader may borrow more than one book, and in different subjects, the total contact time per twenty-four hour period for each user is calculated and it is designated as E'' , where;

$$E'' = \frac{\sum_t \sum_i \sum_j u'_{ijt}}{\sum_t m'_t}$$

where u'_{ijt} is the contact time of the j th book which has been on loan for t days by the i th user and m'_t is the number of users with books on loan t days.

Tables 23 and 24 are summaries of descriptive statistics for students' attributes and total contact times for UWO and McGill. Since the undergraduate students are enrolled in a variety of disciplines, an attempt was made to standardize the disciplines and major areas of study into concentrations following the main faculties in each university. Therefore, for UWO, three concentrations of Arts, Social sciences, and Sciences, and for McGill, two concentrations of Arts and Sciences were created.

4.4.1.0 Borrowers and Non-Borrowers

Table 25 compares the attributes of the borrowers and non-borrowers for UWO and McGill data sets. Assuming that the data are derived from a random sample

TABLE 23

SUMMARY STATISTICS FOR THE READERS' ATTRIBUTES
AND CONTACT TIMES
UWO

	MODE	MEDIAN	MEAN	S.D.
MAJOR	SOCIAL SCIENCE	-	-	-
NUMBER OF COURSES	5	5	4.6	1.34
YEAR OF STUDY	3	3	2.5	1.01
NUMBER OF BOOKS	1	3	4.8	4.14
CONTACT TIME	60	90	155.12	154.47
PAGES READ	100	95	134.64	170.00

TABLE 24

SUMMARY STATISTICS FOR THE READERS' ATTRIBUTES
AND CONTACT TIMES
McGILL

MAJOR	ARTS	-	-	-
NUMBER OF COURSES	5	5	4.7	0.83
YEAR OF STUDY	3	2	2.3	0.94
NUMBER OF BOOKS	1	3	3.8	3.20
CONTACT TIME	60	100	120.83	95.33
PAGES READ	30	60	102.30	97.66

TABLE 26
ATTRIBUTES OF BORROWERS AND NON-BORROWERS

	UWO (%)		McGILL (%)	
	BORR.	NON-BORR.	BORR.	NON-BORR.
<u>MAJOR</u>				
ARTS	30 (21)	24 (11)	71 (64)	146 (60)
SOCIAL SCI	60 (41)	108 (47)	-	-
SCIENCE	56 (38)	96 (42)	40 (36)	98 (40)
	CHI-SQUARE=7.28 d.f.=2		CHI-SQUARE=0.55 d.f.=1	
<u>YEAR</u>				
FIRST	28 (19)	74 (33)	27 (24)	89 (37)
SECOND	41 (28)	73 (32)	36 (32)	88 (36)
THIRD	51 (35)	58 (25)	38 (34)	61 (25)
	CHI-SQUARE=8.53 d.f.=2		CHI-SQUARE=5.88 d.f.=2	
<u>STATUS</u>				
PART-TIME	20 (14)	47 (21)	6 (6)	30 (12)
FULL-TIME	126 (86)	181 (79)	104 (94)	214 (88)
	CHI-SQUARE=2.89 d.f.=1		CHI-SQUARE=3.88 d.f.=1	

of the students who borrow library books and those who do not, Chi-Square calculations indicate that, at 0.05 significance level:

(a) There is a dependency between students' concentrations and their book borrowing habits at UWO. Art students seem to check-out more library books in proportion to the number of books borrowed by students in other concentrations. This dependency does not hold in case of McGill students.

(b) At UWO, borrowing is dependent on the year of study of the student. At McGill, however, the calculated value of Chi-square is too close to the critical Chi-square for reliable inference. In general, it is possible that the more advanced students tend to borrow more library books than others.

(c) There is no significant difference between part-time and full-time students in their borrowing activity at UWO.. The Chi-square calculations for McGill is not conclusive.

4.4.1.1' $H_0(1)$: No significant difference in average total contact time/user per twenty-four hour period among various subject concentrations

To test the null hypothesis that there is no

significant difference in average total contact times/user among various subject concentrations, an analysis of variance was carried out for UWO data. The statistics indicate that the null hypothesis cannot be rejected (Table 26, Appendix F).

For McGill data set, students in the sample were divided into two categories of Arts and Sciences. Statistics from a two sample test indicates no significant difference in average total contact times per twenty-four hour period between arts and science students (Table 27, Appendix F).

Therefore students' subject concentrations do not influence the average amount of time they spend with the borrowed library books in a twenty-four hour period.

4.4.1.2. Ho(2): No significant difference in average total contact times per twenty-four hour period between part-time and full-time students

Data analysis for UWO indicates that the result of the Kruskal-Wallis test is inconclusive, (Table 28, Appendix F). The average contact times show that students enrolled in three or six courses spend less time with the borrowed books than others. One possible explanation for these results is that part-time students (those with less than four courses) can not spend as

much time with the books they borrow from the university library system as their full-time colleagues. On the other hand, students enrolled in more than five courses may be too busy to spend as much time with the borrowed books as others.

For McGill data set, insufficient data for part-time students do not permit an analysis.

4.4.1.3 Ho(3): No significant difference in average total contact times per twenty-four hour period among students in different years of study

The results of the analysis of variance for UWO data show that there are no significant differences in average total contact times among the students in various years of study (Table 29, Appendix F).

At McGill, the results are different. Both tests, analysis of variance and Kruskal-Wallis, show a significant difference among groups. In particular there seems to be a major difference between first and third year students. While the latter group spends on average about two and one half hours per twenty-four hour period in book reading activities, first year students spend about one hour and fifteen minutes on reading (Table 30, Appendix F). Therefore, it is

2

MICROCOPY RESOLUTION TEST CHART
NBS - 1010a
(ANSI and ISO TEST CHART No. 2)

1.0	1.5	2.8	2.5
	1.8	3.2	2.2
1.1	2.0	3.6	2.0
	2.2	4.0	1.8
1.25	2.5	4.5	1.6
1.4	2.8	5.0	

possible that, in some institutions, as students mature and acquire learning skills, they spend more time on reading the library books that they borrow. Another reason for this discrepancy between first and third year students could be due to the nature of the assignments required from each group. Assignments given to freshmen may not require the use of library books to the same extent as those given to upper class students.

4.4.1.4 $H_0(4)$: No significant difference in average or median total contact times per twenty-four hour period for the undergraduate students between two universities

All the data are used to test the hypothesis that the students at UWO and McGill on average spend the same amount of time on books they borrow per twenty-four hour period. A two sample test based on the means and a Mann-Whitney test based on the medians indicate that there is no significant difference in average or median contact times per student between the two populations. (Table 31). In spite of all their characteristic differences, it seems that UWO and McGill undergraduate students on average spend the same amount of time reading the borrowed library books per day. This is an important finding since it may show a 'universality' for

contact times similar to retention period universality
shown by Shaw.⁷

TABLE 31
HYPOTHESIS TESTS FOR TOTAL CONTACT TIME PER STUDENT (E")
BETWEEN UWO AND MCGILL

<u>TWO SAMPLE T TEST</u>			
UWO	N = 81	MEAN = 155.12	S.D. = 154.47
MCGILL	N = 54	MEAN = 120.83	S.D. = 95.33
DEGREES OF FREEDOM = 132			
TEST OF H ₀ : T = 1.594 PROB > T = 0.1134			
<u>MANN WHITNEY TEST</u>			
UWO	N = 81	MEDIAN = 90.0	
MCGILL	N = 54	MEDIAN = 100.0	
TEST OF H ₀ : W = 5615.0 PROB > W = 0.6324			

⁷Shaw, p. 158.

4.4.1.5 Other variables

In order to check the effect of the time of the interview on the contact times, the dates of the interviews were coded into days of the week. Saturday and Sunday were combined to represent the weekend. Analysis of variance shows no significant difference in average total contact times per twenty-four hour period among the various days of the week, even though the averages are slightly lower for the weekends. The results are similar for both universities (Tables 32 and 33, Appendix F).

The number of pages read or browsed has moderate positive linear correlation with the total contact times per student per twenty-four hour period. For McGill and UWO data sets, Pearson product-moment correlation coefficients are; $r=0.514$ and $r=0.567$ respectively. It is noteworthy that the correlation coefficients between contact times and number of pages read/browsed are about the same for both universities.

4.4.2 Books

In this section the average contact times for books are analyzed, based on the attributes of the books and

on the reasons for borrowing them. Figures 8 to 15 (Appendix G) show the descriptive statistics for UWO and McGill students' borrowed books. The Library of Congress classification has been used to categorize the books. The courses for which the books are borrowed have been grouped using the LC classification. Based on the sample data, there are certain similar characteristics between the two universities. The combined N and P classifications, fine arts and literature, form the largest group of borrowed books in the sample for both universities (21% for UWO and 22% for McGill). The purpose of borrowing a book in 86% and 70% of all the cases was for a "written assignment" at UWO and McGill respectively. About 27% of the books were borrowed for science and engineering courses. Approximately 46% to 47% of materials borrowed were found to be of "average" difficulty, while 33% were "very useful" in both universities.

In order to test various hypotheses relating to contact times, data were regrouped. For both universities, the subject matter of books are classified into concentrations of Arts, Social sciences, and Science. The latter includes natural sciences, engineering, and health sciences, while the Arts class includes music and fine arts. Reclassification of data into only two concentrations of Arts and Science would result in loss of information, even though McGill

University does not have a Social science faculty.

4.4.2.1 Ho(5): No significant difference in average contact times for books in various subject concentrations

The first hypothesis regarding the books, their subject matter and the average contact times, was tested using analysis of variance and a Kruskal-Wallis test. The hypothesis cannot be rejected for UWO and McGill. The average amount of time per day students spend reading books is independent of the subject of the books (Tables 34 and 35, Appendix G).

4.4.2.2 Ho(6): No significant difference in average contact times between borrowing a book for written assignments and other purposes

The purpose for borrowing a book had five categories as a question on the interview schedule. Because of insufficient data this question is regrouped into borrowing a book for "written assignments" and other purposes. A two sample test is used, and in both UWO's and McGill's cases the null hypothesis cannot be rejected (Tables 36 and 37, Appendix G). Therefore the

time spent per day on books does not depend on the purpose for which those books were borrowed from the library system.

4.4.2.3 Ho(7): No significant difference in average contact times among concentrations of courses for which the books were borrowed

An analysis of variance test shows no significant difference in contact times among the three subject concentrations for UWO (Table 38, Appendix G). The average times range from 68 minutes for Sciences to 84 minutes for the Social sciences. For McGill data set, the courses are grouped into Arts and Sciences concentrations as these are the two major undergraduate faculties. The test statistics show a significant difference in contact times (Table 39, Appendix G). While the students on average spend 83 minutes reading borrowed books for science courses per day, only 56 minutes are spent for the art courses. A second set of data is created by reclassifying the courses into three concentrations of Arts, Social sciences, and Science. A Kruskal-Wallis test confirms the previous finding that there is a significant difference in contact times for books borrowed for courses in various concentrations (Table 40, Appendix G). The significant difference,

however, remains between the science concentration and the arts and social science concentrations. In fact, the difference between the average contact times for the arts and social science concentrations is only one minute.

4.4.2.4 Relationship of contact time with difficulty, usefulness, and study technique

Difficulty and usefulness are both subjective measures which are best decided by the users. At the time of the telephone survey at UWO, the students were asked how difficult and how useful they found the individual books. This was done without any prior knowledge of whether they had had a chance to read the book. Hence some cases had to be excluded from calculations. The remaining data were grouped into three categories: most difficult, average, and least difficult. Analysis of variance indicates that there is no significant difference in average contact times among the three categories (Table 41, Appendix G). The same procedure is used for usefulness with a different result. The F statistic shows a significant change in contact times, from 58 minutes for books found to be "not useful" to 110 minutes for books which were considered to be "very useful" (Table 42, Appendix G).

The telephone survey schedule for McGill contains a question regarding the reading of the book subsequent to its borrowing. For the difficulty scale, statistics show that no significant differences are apparent among the various categories (Table 43, Appendix G).

The usefulness scale is grouped according to the categories very useful, average, and least useful, with the last category containing the "not useful" cases. Results show that the average contact times increase from 42 minutes for the least useful to 74 minutes for the most useful books. However, the values of the F statistics and Chi-square are too close to the critical values and not conclusive (Table 44, Appendix G).

These results may suggest that the amount of time students spend reading borrowed library books may be related to how useful they find them and not to how difficult the books are.

For both universities, a significant difference is observed between average contact times for taking notes while reading books and otherwise (Tables 45 and 46, Appendix G). For McGill the average times range from 44 minutes if no notes are taken during the reading act, to 80 minutes if notes are written down (ratio $80/44 = 1.8$). In the case of UWO, the average times are 58 minutes for reading without note taking and 95 minutes otherwise (ratio $95/58 = 1.6$). It seems that taking notes while reading increases the students' average contact times by

the attributes of the readers and the books.

The results of a number of hypothesis tests indicate that uses and non-uses of the library books borrowed by the undergraduate students are not dependent on the attributes of the readers or the books. The only exception is the correlation between use and how useful the students found the books.

3. To find the shape of the contact time distributions, $Q(t)$, over retention period.

The results indicate that the contact times are dispersed randomly over the loan period and are stationary with no significant increases or decreases. In the case of the synchronous data from McGill, there is a statistically significant increase observed from the first day to the twelfth day, but this trend may be due to insufficient data for the entire retention time. The average contact time per user per book in a 24 hour period is about one hour for McGill students and one hour and fifteen minutes for UWO students.

4. To find the shape of the contact time frequency distribution or density function $f(u)$.

The results indicate that the frequency distributions for synchronous and diachronous data belong to a double parameter gamma distribution family. Hence, any conclusions based on the arithmetic means

4.5.1 Subject Concentration of the books

The subject of the books borrowed in both universities is analyzed to find any correlation with other variables, with the following results:

(a) A Chi-square test indicates a significant dependency between subject of the books and subject of the courses (as defined by concentrations) for which they were borrowed at UWO and McGill (Tables 47 and 48, Appendix H). A high Cramer's V demonstrates a strong correlation between the two variables, indicating that the undergraduate students borrow library books which cover subjects specifically for courses in their concentrations. Research reported in the literature confirms the above findings.⁹

(b) The subject of the books and purpose for which they were borrowed are dependent for UWO data (Table 49, Appendix H). Books on the subject of arts and humanities are proportionally borrowed more than books on other concentrations for the purposes other than for writing assignments. McGill data, on the other hand, does not show such a dependency (Table 50, Appendix H). Books borrowed for purposes other than for writing an assignment are fairly evenly distributed among all major

⁹William E. McGrath. "The Significance of Books Used According to a Classified Profile of Academic Departments," College and Research Libraries 33(May 1972): 212-219.

subject areas.

(c) The difficulty of the books and their subject seem to be dependent at McGill but not at UWO (Tables 51 and 52, Appendix H). McGill students find humanities and arts books to be less difficult than other subjects. Such an assessment was not made by UWO students.

(d) Usefulness of the books and their subjects seem to have a similar pattern of relationship as the variables 'difficulty' and 'subject' (Tables 53 and 54, Appendix H). While at McGill students found the arts and humanities books to be proportionally less useful than other concentrations, UWO students did not assess any particular subject to be more or less useful than others.

4.5.2 Subject Concentration of the Courses

The subject concentration of the courses for which the books were borrowed was analyzed to determine any correlation patterns with the other independent variables. The results are as follows.

(a) The subject concentration of the courses and the level of difficulty of the books borrowed are independent from each other in both universities (Tables 55 and 56, Appendix H).

(b) The level of usefulness of the books borrowed does not show any significant dependency on the subject concentration of the courses (Tables 57 and 58, Appendix H).

These results illustrate that the difficulty or usefulness of books do not depend on the subject concentration of the courses for which they are borrowed from the university library systems at UWO or McGill.

4.5.3 Retention Period

Retention time is the period for which the books have been held by the undergraduate students at the time of the telephone interview. Although the total retention period will be longer than the recorded data may indicate, it remains a useful measure, and indicative of the amount of time the students will keep the borrowed books. Retention time was analyzed in relation with other variables to determine if any patterns exist among them.

(a) Retention time at McGill seems to be correlated with the subject concentration of the books. Arts and humanities books were on loan for an average of 12 days while science books were retained for an average of 8 days (Table 59, Appendix H). This finding confirms

the results of other research reported in the literature.¹⁰ The Kruskal-Wallis test for UWO indicates that the results are not conclusive (Table 60, Appendix H).

(b) The retention period does not depend on the subject concentration of the courses for which the books were borrowed for UWO (Table 61, Appendix H). However, analysis of variance and Kruskal-Wallis test show that there is a significant difference in retention period among the three major concentrations at McGill (Table 62, Appendix H). Borrowed books were held for an average of 13 days for arts and humanities concentration as opposed to 8 days for social science concentration.

(c) The purpose for which the books were borrowed and retention time are correlated for UWO data, but not for McGill data (Tables 63 and 64, Appendix H). The former data indicate that the average retention time for other purposes is 4 days more than for written assignments. At McGill the retention time for both categories is about 10 days.

(d) The retention period does not show any dependency on how difficult and/or how useful the borrowed books are to undergraduate students (Tables 65 through 68, Appendix H).

¹⁰Reginald P. Coady "A Comparison of Single Book Renewals by Subject and Patron Status for Similar Rates of Renewal and Return," Journal of the American Society for Information Science 37(1986): 85.

The above differences between UWO and McGill may be due to the official loan policies at the two institutions. The subject concentration of the books and/or the courses for which they are borrowed may not affect the rate of return of the books if the loan period is four weeks, as, the case of UWO.

CHAPTER V

CONCLUSIONS

The objectives and the findings of this research are:

1. To find the shape of the book use distribution, $V(t)$, as defined by the non-zero contact times between the undergraduate students and the books they borrow.

The cumulative distributions have been found to be of a linear-log type, $V(t) = a + b \log(t)$, somewhat similar in shape to a Bradford type distribution. The synchronous samples indicate that 58% and 62% of all the library book uses occur in the first week of borrowing for UWO and McGill respectively. Over 90% of the uses in the data collected from both institutions take place within the official loan period regardless of the length of the period.

2. To find the relationship between book use and

the attributes of the readers and the books.

The results of a number of hypothesis tests indicate that uses and non-uses of the library books borrowed by the undergraduate students are not dependent on the attributes of the readers or the books. The only exception is the correlation between use and how useful the students found the books.

3. To find the shape of the contact time distributions, $Q(t)$, over retention period.

The results indicate that the contact times are dispersed randomly over the loan period and are stationary with no significant increases or decreases. In the case of the synchronous data from McGill, there is a statistically significant increase observed from the first day to the twelfth day, but this trend may be due to insufficient data for the entire retention time. The average contact time per user per book in a 24 hour period is about one hour for McGill students and one hour and fifteen minutes for UWO students.

4. To find the shape of the contact time frequency distribution or density function $f(u)$.

The results indicate that the frequency distributions for synchronous and diachronous data belong to a double parameter gamma distribution family. Hence, any conclusions based on the arithmetic means

PILOT PROJECT

A Summary

During March and April 1983, a pilot project on the patterns of book use in an academic library was conducted in the University of Western Ontario. The main focus of the study was to create a use typology by interviewing a randomly selected group of library users.

Sixty one library users were interviewed. The interview schedule consisted of questions on the user's status, level and year of study, area of study or discipline, subject of the borrowed book, source of information about the book, retention time, the extent of the book use in terms of the amount read, and the purpose for which the book was borrowed. In addition, each interviewee was requested to identify the length of time since they last returned a book to the library system.

Data analysis showed that more than 75% of the interviewees were undergraduate students, 11% graduate students, and the remaining data consisted of faculty, staff, and others. The students in the sample were from various disciplines and represented the general student population at UWO. The books they had borrowed and returned to the library system represented three broad subject concentrations of Arts, Social Science, and

they spend reading library books per twenty-four hour period.

(c) The statistical tests demonstrating the relationship between number of courses and contact times are inconclusive.

(d) While students in various years of study at UWO do not differ significantly in their contact times, McGill students may have some differences. Specifically, first year students spend less time per twenty-four hour period reading books borrowed from the library system than their third year colleagues.

(e) There are no significant differences in average or median total twenty-four hours contact times per student between UWO and McGill. This is an important result which may indicate a universality in contact times regardless of the loan period.

7. To find the relationship between number of pages read/browsed and total contact time per student.

The results of Pearson product-moment correlation coefficient show that the number of pages read/browsed has a moderate linear correlation with contact times, with similar correlation coefficients for both universities.

8. To find the relationships between the books' attributes and contact times.

Tests of hypotheses show that:

(a) The amount of time spent reading borrowed books per day is not significantly different for subject concentrations of Arts, Social science, and Science.

(b) The average contact times per day are independent of the purpose for which the books are borrowed.

(c) At UWO, contact times per day are independent of the subject concentration of the courses for which the books are borrowed. At McGill, however, contact times may be dependent on the subject concentration of the courses.

(d) Contact times per day are not dependant on the undergraduate students' evaluation of how difficult the books are, but rather on how useful the students have found them.

(e) Taking notes while reading the borrowed library books has a significant effect on the contact time per day and increases the students' average contact times by a factor of 1.6 to 1.8.

9. To find the relationships among the independent variables.

Statistical analyses indicate that:

(a) There is a significant dependency between subject concentration of the books and subject concentration of the courses for which they were borrowed at UWO and McGill.

(b) The subject concentration of the books and purpose for which they were borrowed are dependent for UWO data. McGill data does not show such a dependency.

(c) The difficulty and usefulness of the books and their subject concentration may be dependent at McGill but not at UWO.

(d) The subject concentration of the courses and the level of difficulty and usefulness of the books borrowed are independent of each other in both universities.

(e) Retention period at McGill and UWO may be correlated with the subject concentration of the books.

(f) Retention period is correlated with the subject concentration of the courses for which the books were borrowed for McGill, but not for UWO data.

(g) The purpose for which the books are borrowed and retention time are correlated for UWO data, but not for McGill data.

(h) Retention period does not show any dependency on how difficult and/or how useful the borrowed books are to undergraduate students.

Certain implications arise from the results of this research. First, books charged out of the library system of two different academic institutions are used shortly after borrowing. The usage of these documents does not have any relationship with the attributes of

the students or of the books themselves. However, use is related to how useful the students have found the books. Second, if the contact time is indeed independent of the loan period, then, instead of using return rates as a factor in determining the loan length, contact times should be used. Third, if contact times are limited to a few days during the loan period, especially if the contact occurs within the first week or so, then the loan period may be shortened. The reduction of the loan length remains, however, a managerial decision based on user attitude, renewal policy, and convenience for the user and the library. Nevertheless, choosing to have "semester" or even "four weeks" loan periods for undergraduate students are decisions which, without investigating the nature and the amount of contact times, may be questionable. Fourth, loan period should be the same for all the undergraduate students, regardless of their subject concentration. Similarly, the loan period should be the same for books in different subject areas, even though they may show different circulation patterns and return rates. Fifth, in some academic institutions, contact times may be dependent on the year of study of undergraduate students and therefore loan period may be adjusted to suit the students' needs. Finally, in some universities contact times may be dependent on the subject of the courses for which the library books are

borrowed, hence the loan period may be adjusted accordingly.

Since students in the two universities under study differ in some of their characteristics, further research is needed in other institutions to substantiate the above findings. In particular, research is needed to determine whether the contact times are different for (a) students in various years of study, and for (b) subject of the courses for which the books are borrowed.

In addition, further research could be conducted on the contact times for the graduate students and faculty to determine the similarities and differences among various user groups. Research could also be carried out into the patterns of book use in other types of libraries with different user populations.

A subject needing further research is the provision of alternative means of transferring information to the students. If the average total contact time with each book which has been borrowed from the library is no more than two hours, then it may be feasible and cost effective to provide in other media the same information contained in the book. It is estimated that by the late 1980's, an optical disk jukebox will be able to store about 4.12×10^6 full-text pages, or the equivalent to roughly three million documents.¹ The possibility of

¹F.E. Marsh Jr., "Videodisc Technology," Journal of the American Society for Information Science 33(1982): 237-244.

providing the same information that exists in the circulating books in machine readable form definitely exists. Hundreds of dollars may be saved in the processing of these books if computer retrieval systems could replace them. The merits of books versus computers as the learning media have been discussed elsewhere.² Suffice it to say that if the contact time between undergraduate students and the borrowed books is indeed minimal, academic libraries should carry out more research to find alternative, more cost effective ways of providing the information the students need.

²F.W. Lancaster, Libraries and Librarians in an age of electronics (Arlington, Va.: Information Resources Press, 1982).

³A. Bork, "Books versus Computers - Learning Media," Communicating Information: Proceedings of the 43rd ASIS Annual Meeting, 1980 (Minneapolis, MN: American Society for Information Science, 1980).

APPENDIX A

PILOT PROJECT

A SUMMARY

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Data analysis showed that more than 75% of the interviewees were undergraduate students, 11% graduate students, and the remaining data consisted of faculty, staff, and others. The students in the sample were from various disciplines and represented the general student population at UWO. The books they had borrowed and returned to the library system represented three broad subject concentrations of Arts, Social Science, and

Science. More than 64% of the books were located through browsing the subject catalogue and the book shelves. Over a third of the interviewees had read about half of the books they had borrowed, while 12% had read the entire books. Written assignment was mentioned in 59% of the cases as the purpose for borrowing and using the library books.

Statistical analysis showed that certain independent variables such as year of study and status, not surprisingly, were interrelated. Some associations were found between amount of a book read, and the area of study and subject of the book. The purpose for borrowing was also found to be correlated to area of study, subject of the book, source of information about the book, and amount read.

An attempt to create a use typology by combining two variables, the amount of a book read and the purpose for which it was borrowed, proved to be unproductive. The two variables, however, showed significant relationship with users' subject concentrations. In general, the results demonstrated that undergraduate students have a different information "need," in terms of the purpose for borrowing a book, than the graduate students, or other borrowers.

APPENDIX B

DIARY SCHEDULE

DIARY

My name is Jamshid Beheshti. I am a doctoral student at the School of Library and Information Science, the University of Western Ontario. As part of my dissertation, I am conducting a study on the extent of use of library books by the students. I would very much appreciate your participation in this study. Your responses will be strictly confidential.

Many studies on the use of library materials have been conducted in the past, but few have addressed the actual use of books once they leave the library system. Questions such as what do patrons do with the books and how much are they read, are the primary foci of this doctoral dissertation research. It is hoped that by answering some of these questions, a more efficient and effective library service will be provided to the users.

In addition to contributing to a research project, your participation may help you develop a better understanding of your reading/study techniques. Furthermore, as a token of my appreciation, you may have a chance to win a prize which will be given by a draw to a participant at the end of this project.

If you have decided to take part in this study, would you please read and sign the following form:

I agree to participate in a study on library book use conducted by Jamshid Beheshti, the results of which will be published in his doctoral dissertation.

INSTRUCTIONS

Keeping diaries on the amount of time you spend with the library books may help you develop a better understanding of your study techniques and reading habits. Therefore, the information you record should be as accurate as possible.

The first page of the diary deals with information about you. Your name, discipline, number of courses currently enrolled in, and year of study. The second page should be filled out for each book you check out of the McGill University library system. These will be books with a regular loan period of 14 days, excluding periodicals and government publications. You will answer questions 5 through 8 for each book. Then, beginning on Day 1, which is the day the book is checked out, you record:

1. TIME: the time you spend each day with a particular book. The time should be recorded in minutes and accurate to within 5 minutes, e.g., 10, 120, 85, etc. Enter 0 (zero) if you do not read the book every day.

2. PAGES: the number of pages you read or browse should be recorded, e.g., 5, 9, 52, etc.

3. NOTES: if you take any notes while you are reading the book, you will enter an "N" under "NOTES"; if you simply note the page number of the book for future reference while you are reading, please enter a "P"; otherwise leave the column blank.

If you keep the book longer than 14 days, enter the additional information starting on Day 15, and if necessary, continue on a separate diary, but make sure you note the "Call number" in question 5. Before returning the book, please answer questions 9 through 11.

All the diaries should be returned to me by April, 1985. Once the diaries have been reviewed, I will contact you for an appointment at your convenience, for a brief interview regarding your diaries.

If you have any questions and/or comments regarding this research, please contact me at the Graduate School of Library Science, McGill University, telephone 392-5930.

Page 1

1. Name
2. Major field of study or discipline
3. Number of courses in which you are currently enrolled ...
4. Year of study ...

- 5. Call number
- 6. The main purpose for borrowing this book (please check only one):
 Written assignment ... Classroom reading ...
 Exam preparation ... General education ... Entertainment ...
- 7. Course for which this book was borrowed (if any)
- 8. Date borrowed
- 9. Did you find this book:
 very difficult difficult average easy very easy
- 10. For your purposes, was this book:
 very useful useful somewhat useful not useful
- 11. Date returned

DAY	TIME	PAGE	NOTES	DAY	TIME	PAGE	NOTES
1				15			
2				16			
3				17			
4				18			
5				19			
6				20			
7				21			
8				22			
9				23			
10				24			
11				25			
12				26			
13				27			
14				28			

APPENDIX C

TELEPHONE INTERVIEW SCHEDULE.

TELEPHONE INTERVIEW

Date Time

Case number

Hello. Am I speaking to Mr./Ms.?

My name * is I am conducting a survey on behalf of Mr. Jamshid Beheshti, a doctoral student at the School of Library and Information Science, University of Western Ontario. Your name has been chosen randomly from a list of students who have given their permission to the Registrar's Office for the release of their telephone numbers for the creation of a student telephone directory, to participate in a study on the extent of the use of library books. You are not under obligation to answer any of the following questions. Your responses will be strictly confidential.

1. What is your major field of study?
2. How many courses are you currently enrolled in? ...
3. What year of study are you in? ...
4. Do you now have any library books out? yes no
(if no, go to last paragraph on page two)
5. If so, how many books? ...

Page 2

Case ...

6. What is the call number of the (first) book you have checked out of the library?

7. What is the main purpose for borrowing this book? (please check only one):

Written assignment ... Classroom reading ...

Exam preparation ... General education ... Entertainment ...

8. What is the course for which this book was borrowed (if any)?

9. How long have you had this book? ...

10. Have you had a chance to read this book? yes no

11. In the past 24 hours:

(a) How much time did you spend with this book? ...

(b) How many pages did you read or browsed? ...

(c) Did you take notes while reading this book? yes no

12. Have you found this book:

very difficult difficult average easy very easy

13. For your purposes, has this book been:

very useful useful somewhat useful not useful

14. When do you have to return this book to the library?

(please check the inside cover of the book for the due date) ...

Thank you for participating in this study. If you have any questions and/or comments regarding this research, please contact Jamshid Beheshti at the Graduate School of Library Science, McGill University.

APPENDIX D

USE DATA

TABLE 4
NUMBER OF USES AND RETENTION PERIOD - UWØ

DAY	USES	RELATIVE	CUMULATIVE
1	22	14.2857	14.286
2	13	8.4416	22.727
3	9	5.8442	28.571
4	9	5.8442	34.416
5	17	11.0390	45.455
6	10	6.4935	51.948
7	9	5.8442	57.792
8	6	3.8961	61.688
10	4	2.5974	64.286
11	2	1.2987	65.584
12	3	1.9481	67.532
13	4	2.5974	70.130
14	1	0.6494	70.779
15	1	0.6494	71.428
16	1	0.6494	72.078
17	3	1.9481	74.026
18	1	0.6494	74.675
19	4	2.5974	77.273
20	3	1.9481	79.221
21	3	1.9481	81.169
24	3	1.9481	83.117
25	2	1.2987	84.415
26	3	1.9481	86.363
27	2	1.2987	87.662
28	6	3.8961	91.558
29	2	1.2987	92.857
30	1	0.6494	93.506
33	3	1.9481	95.454
35	3	1.9481	97.402
36	2	1.2987	98.701
48	1	0.6494	99.350
54	1	0.6494	100.000

TOTAL 154

TABLE 5
 NUMBER OF USES AND RETENTION PERIOD - MCGILL

DAY	USES	RELATIVE	CUMULATIVE
1	9	8.5714	8.571
2	11	10.4762	19.048
3	5	4.7619	23.810
4	9	8.5714	32.381
5	18	17.1429	49.524
6	9	8.5714	58.095
7	4	3.8095	61.905
8	5	4.7619	66.667
9	6	5.7143	72.381
10	12	11.4286	83.809
11	4	3.8095	87.619
12	3	2.8571	90.476
13	2	1.9048	92.381
15	1	0.9524	93.333
16	1	0.9524	94.286
18	1	0.9524	95.238
27	1	0.9524	96.190
29	1	0.9524	97.143
31	1	0.9524	98.095
36	1	0.9524	99.048
39	1	0.9524	100.000
TOTAL		105	

TABLE 6

NUMBER OF USES AND RETENTION PERIOD - DIARY DATA

DAY	USES	RELATIVE	CUMULATIVE
1	44	26.8293	26.829
2	17	10.3658	37.195
3	19	11.5854	48.780
4	19	11.5854	60.366
5	15	9.1463	69.512
6	7	4.2683	73.780
7	3	1.8293	75.610
8	3	1.8293	77.439
9	1	0.6098	78.049
10	4	2.4390	80.488
11	4	2.4390	82.927
12	2	1.2195	84.146
13	2	1.2195	85.366
14	3	1.8293	87.195
15	1	0.6098	87.805
16	1	0.6098	88.415
17	2	1.2195	89.634
18	4	2.4390	92.073
19	2	1.2195	93.293
20	2	1.2195	94.512
21	1	0.6098	95.122
23	1	0.6098	95.732
24	1	0.6098	96.341
26	2	1.2195	97.561
33	1	0.6098	98.171
34	1	0.6098	98.780
35	1	0.6098	99.390
36	1	0.6098	100.000

TOTAL 164

TABLE 8

STUDENTS' MAJOR AREAS OF STUDY AND BOOK USES AND NON-USES

UWO

MAJOR	NON-USES	USES	TOTALS
ARTS	13	17	30
SOCIAL SCI.	25	35	60
SCIENCE	27	29	56
TOTALS	65	81	146

CHI-SQUARE = 0.52 D.F. = 2 P > 0.05

McGILL

MAJOR	NON-USES	USES	TOTALS
ARTS	34	37	71
SCIENCE	23	17	40
TOTALS	57	54	111

CHI-SQUARE = 0.95 D.F. = 1 P > 0.05

TABLE 9

NUMBER OF COURSES AND BOOK USES AND NON-USES

UWO

NO. COURSE	NON-USES	USES	TOTALS
LESS THAN 4	11	8	19
4	7	13	20
5	37	52	89
MORE THAN 5	9	8	17
TOTALS	64	81	145

CHI-SQUARE = 2.91 D.F. = 3 P > 0.05

McGILL

NO. COURSE	NON-USES	USES	TOTALS
LESS THAN 4	4	2	6
4	14	14	28
5	34	30	64
MORE THAN 5	4	8	12
TOTALS	65	54	110

CHI-SQUARE = 2.21 D.F. = 3 P > 0.05

TABLE 10

YEARS OF STUDY AND BOOK USES AND NON-USES

UWO

YEAR OF STUDY	NON-USES	USES	TOTALS
FIRST	12	16	28
SECOND	17	24	41
THIRD	23	28	51
TOTALS	52	68	120

CHI-SQUARE = 0.13 D.F. = 2 P > 0.05

McGILL

YEAR OF STUDY	NON-USES	USES	TOTALS
FIRST	10	17	27
SECOND	22	14	36
THIRD	19	19	38
TOTALS	51	50	101

CHI-SQUARE = 3.58 D.F. = 2 P > 0.05

TABLE 11

SUBJECT CONCENTRATION OF BOOKS AND BOOK USES AND NON-USES

UWO

SUBJECT	NON-USES	USES	TOTALS
ARTS	64	37	101
SOCIAL SCI.	98	71	169
SCIENCE	64	43	107
TOTALS	226	151	377

CHI-SQUARE = 0.76 D.F. = 2 P > 0.05

McGILL

SUBJECT	NON-USES	USES	TOTALS
ARTS	104	40	144
SOCIAL SCI.	71	39	110
SCIENCE	71	24	95
TOTALS	246	103	349

CHI-SQUARE = 2.90 D.F. = 2 P > 0.05

TABLE 12

PURPOSE FOR BORROWING BOOKS AND BOOK USES AND NON-USES

UWO

PURPOSE	NON-USES	USES	TOTALS
WRITE ASSIG.	194	141	335
OTHER	37	18	55
TOTALS	231	159	390

CHI-SQUARE = 1.71 D.F. = 1 P > 0.05

McGILL

PURPOSE	NON-USES	USES	TOTALS
WRITE ASSIG.	174	75	249
OTHER	77	31	108
TOTALS	251	106	357

CHI-SQUARE = 0.07 D.F. = 1 P > 0.05

TABLE 13

SUBJECT CONCENTRATION OF COURSES AND BOOK USES AND NON-USES

UWO

SUBJECT	NON-USES	USES	TOTALS
ARTS	50	37	87
SOCIAL SCI.	109	72	181
SCIENCE	62	43	105
TOTALS	221	152	373

CHI-SQUARE = 0.19 D.F. = 2 P > 0.05

McGILL (TWO CONCENTRATIONS)

SUBJECT	NON-USES	USES	TOTALS
ARTS	176	74	250
SCIENCE	64	22	86
TOTALS	240	96	336

CHI-SQUARE = 0.51 D.F. = 1 P > 0.05

TABLE 13-CONTINUED

SUBJECT CONCENTRATION OF COURSES AND BOOK USES AND NON-USES

MCGILL (THREE CONCENTRATIONS)

SUBJECT	NON-USES	USES	TOTALS
ARTS	82	23	105
SOCIAL SCI.	94	51	145
SCIENCE	64	22	86
TOTALS	240	96	336 ^a

CHI-SQUARE = 5.76

D.F. = 2

P > 0.05

TABLE 14

LEVELS OF DIFFICULTY AND BOOK USES AND NON-USES

UWO

DIFFICULTY	NON-USES	USES	TOTALS
MOST 1	6	4	10
2	30	22	52
3	113	65	178
4	61	53	114
LEAST 5	9	11	20
TOTALS	219	155	374

CHI-SQUARE = 4.52 D.F. = 4 P > 0.05

McGILL

DIFFICULTY	NON-USES	USES	TOTALS
MOST 1	6	5	11
2	25	16	41
3	82	46	128
4	54	30	84
LEAST 5	6	9	15
TOTALS	173	106	279

CHI-SQUARE = 3.78 D.F. = 4 P > 0.05

TABLE 15

LEVELS OF USEFULNESS AND BOOK USES AND NON-USES

UWO

USEFULNESS	NON-USES	USES	TOTALS
MOST 1	65	59	124
2	47	39	86
3	60	39	99
LEAST 4	46	15	61
TOTALS	218	152	370

CHI-SQUARE = 9.78 D.F. = 3 P < 0.05

McGILL

USEFULNESS	NON-USES	USES	TOTALS
MOST 1	50	44	94
2	54	33	87
3	57	25	82
LEAST 4	12	3	15
TOTALS	173	105	278

CHI-SQUARE = 7.13 D.F. = 3 P ~ 0.05

APPENDIX E

CONTACT TIME DATA

TABLE 16
AVERAGE CONTACT TIMES WITH 90% CONFIDENCE INTERVAL
UWO DATA

DAY	AVERAGE	LOWER	HIGHER
1	46.1	29.3	63.0
2	56.5	38.6	74.4
3	142.2	84.1	200.4
4	53.9	33.5	74.3
5	115.6	51.5	179.7
6	54.0	30.0	78.0
7	63.3	24.0	101.8
8	46.7	28.9	64.4
10	59.1	2.6	115.6
12	103.3	-42.0	248.7
13	8.8	3.1	14.4
17	45.0	19.7	70.3
19	117.5	-35.1	270.1
20	160.0	5.5	314.5
21	15.0	-7.3	37.3
24	120.0	18.8	221.2
26	30.0	-13.8	73.8
28	95.8	35.9	155.8
33	140.0	-93.6	373.6
35	100.0	-16.8	216.8

TABLE 17
 AVERAGE CONTACT TIMES WITH 90% CONFIDENCE INTERVAL
 MCGILL DATA

DAY	AVERAGE	LOWER	HIGHER
1	27.20	14.52	39.92
2	35.00	23.21	46.79
3	57.00	18.62	95.38
4	48.75	27.43	70.07
5	55.00	39.08	70.92
6	65.00	43.19	86.81
7	61.25	11.24	111.26
8	120.00	59.31	180.69
9	70.00	40.10	99.90
10	58.30	29.75	86.91
11	101.25	-7.91	210.41
12	81.67	-69.20	232.53

TABLE 18
 AVERAGE CONTACT TIMES WITH 90% CONFIDENCE INTERVALS
 DIARY DATA

DAY	AVERAGE	LOWER	HIGHER
1	46.6	32.6	60.6
2	48.2	26.4	70.
3	44.2	30.2	58.2
4	41.4	26.3	56.5
5	42.3	26.7	57.9
6	26.4	-4.1	56.9
7	65.0	-59.2	189.2
8	16.7	-4.5	37.9
10	46.3	26.2	66.3
11	78.8	22.2	135.3
14	35.0	-1.7	71.7
18	37.5	17.4	57.6

APPENDIX F

TESTS OF HYPOTHESES FOR THE READERS

TABLE 26

STUDENTS' MAJOR SUBJECT CONCENTRATIONS
UWOANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE MAJOR
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
ARTS	17	165.00	16830.5	24042.8
SOCIAL SCI.	35	172.71	F VALUE	PROB>F
SCIENCE	29	128.10	0.70	0.4997

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
ARTS	17	639.50	697.00	85.94	37.62
SOCIAL SCI.	35	1586.00	1435.00	104.55	45.31
SCIENCE	29	1095.50	1189.00	101.18	37.78

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 2.09 DF= 2 PROB > CHISQ=0.3523

TABLE 27
 STUDENTS' MAJOR SUBJECT CONCENTRATIONS
 MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE MAJOR
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
ARTS	37	123.92	1118.98	9240.74
SCIENCE	17	114.12	F VALUE	PROB>F
			0.12	0.7293

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
ARTS	37	1030.00	1017.50	53.43	27.84
SCIENCE	17	455.00	467.50	53.43	26.76

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
 (WITH CONTINUITY CORRECTION OF .5)

S= 455.00 Z=-0.2246 PROB >|Z|=0.8223

T-TEST APPROX. SIGNIFICANCE=0.8232

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 0.05 DF= 1 PROB > CHISQ=0.8150

TABLE 28
NUMBER OF COURSES
LWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE NOCOURSE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			40969.9	23196
3	8	86.88		
4	13	170.00	F VALUE	PROB>F
5	52	175.38	1.77	0.1590
6	8	67.50		

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
3	8	247.50	328.00	62.97	30.94
4	13	617.00	533.00	77.47	47.46
5	52	2274.00	2132.00	101.18	43.73
6	8	182.50	328.00	62.97	22.81

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 7.98 DF= 3 PROB > CHISQ=0.0465

TABLE 29

YEAR OF STUDY
LWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE YEAR
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
1	16	91.88	41426.5	21030.4
2	24	184.17	F VALUE	PROB>F
3	28	155.36	1.97	0.1477

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
1	16	438.50	552.00	68.95	27.41
2	24	926.00	828.00	77.68	38.58
3	28	981.50	966.00	80.00	35.05

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 3.12 DF= 2 PROB > CHISQ=0.2097

TABLE 30
 YEAR OF STUDY
 MCGILL

ANALYSIS OF VARIABLE TIME CLASSIFIED BY VARIABLE YEAR
 - AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			32828.6	8568.61
1	17	78.24		
2	14	127.14	F VALUE	PROB>F
3	19	163.68	3.83	0.0287

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
1	17	311.00	433.50	48.60	18.29
2	14	355.00	357.00	46.07	25.36
3	19	609.00	484.50	49.80	32.05

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 8.07 DF= 2 PROB > CHISQ=0.0177

TABLE 32

INTERVIEW DATES,
UWOANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE INTDATE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
MONDAY	34	146.62	4180.31	25174.6
TUESDAY	14	169.29	F VALUE	PROB > F
WEDNESDAY	10	153.00	0.17	0.9722
THURSDAY	8	195.00		
FRIDAY	3	143.33		
WEEKEND	12	140.83		

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H ₀	STD DEV UNDER H ₀	MEAN SCORE
MONDAY	34	1437.00	1394.00	104.16	42.26
TUESDAY	14	560.50	574.00	79.80	40.04
WEDNESDAY	10	412.00	410.00	69.43	41.20
THURSDAY	8	341.50	328.00	62.97	42.69
FRIDAY	3	102.00	123.00	39.86	34.00
WEEKEND	12	468.00	492.00	74.97	39.00

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 0.52 DF= 5 PROB > CHISQ=0.9914

TABLE 33

INTERVIEW DATE

MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE INTDATE
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 17028	WITHIN MS 8260.37
MONDAY	5	225.00		
TUESDAY	11	126.82	F VALUE	PROB>F
WEDNESDAY	17	121.18	2.06	0.0867
THURSDAY	5	128.00		
FRIDAY	10	96.00		
WEEKEND	6	57.50		

WILCOXON SCORES (RANK SUMS)

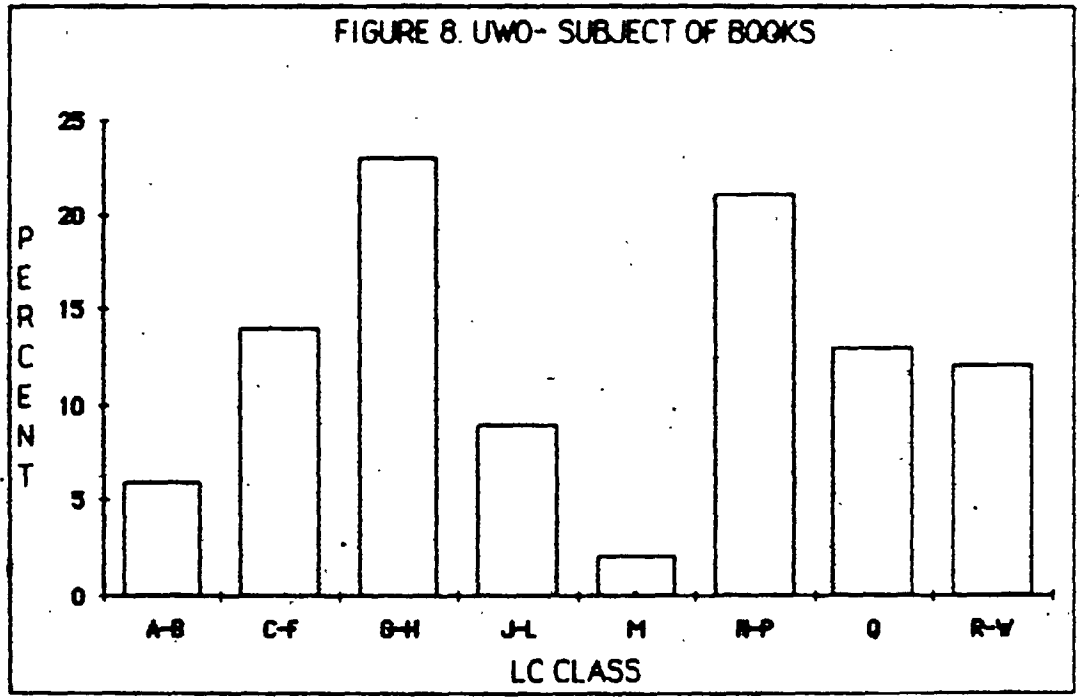
	N	SUM OF SCORES	EXPECTED UNDER H0	STD. DEV UNDER H0	MEAN SCORE
MONDAY	5	211.00	137.50	33.35	42.20
TUESDAY	11	319.50	302.50	46.33	29.05
WEDNESDAY	17	462.50	467.50	53.43	27.21
THURSDAY	5	158.00	137.50	33.35	31.60
FRIDAY	10	242.00	275.00	44.69	24.20
WEEKEND	6	92.00	165.00	36.15	15.33

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 8.93 DF= 5 PROB > CHISQ=0.1118

APPENDIX G

DISTRIBUTIONS AND TESTS OF HYPOTHESES FOR THE BOOKS



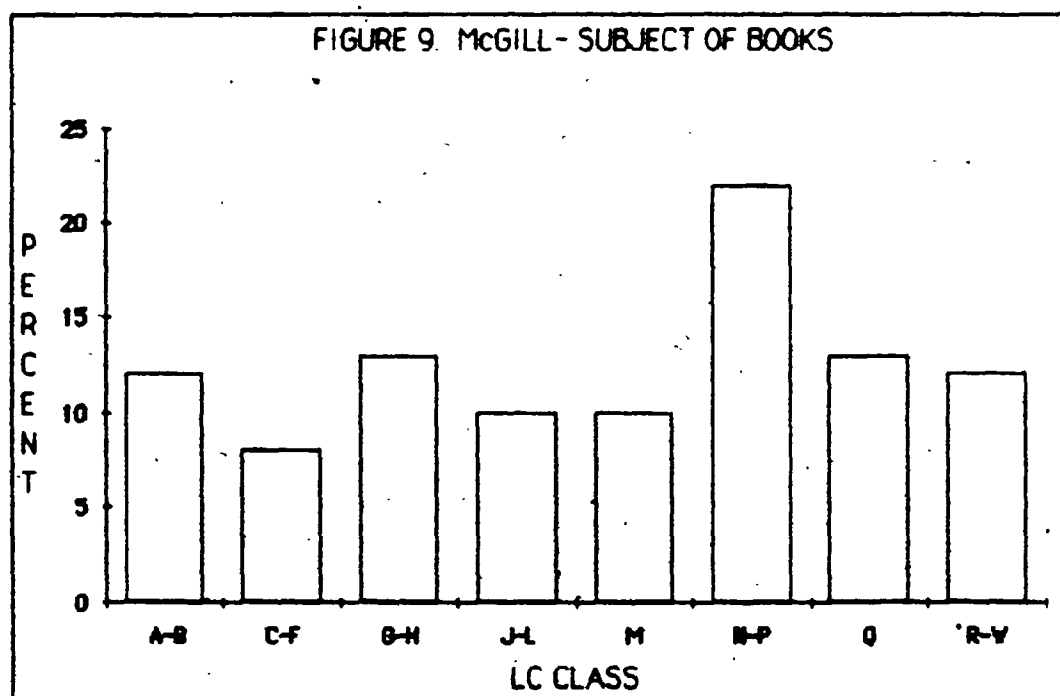


FIGURE 10. UWO- PURPOSE

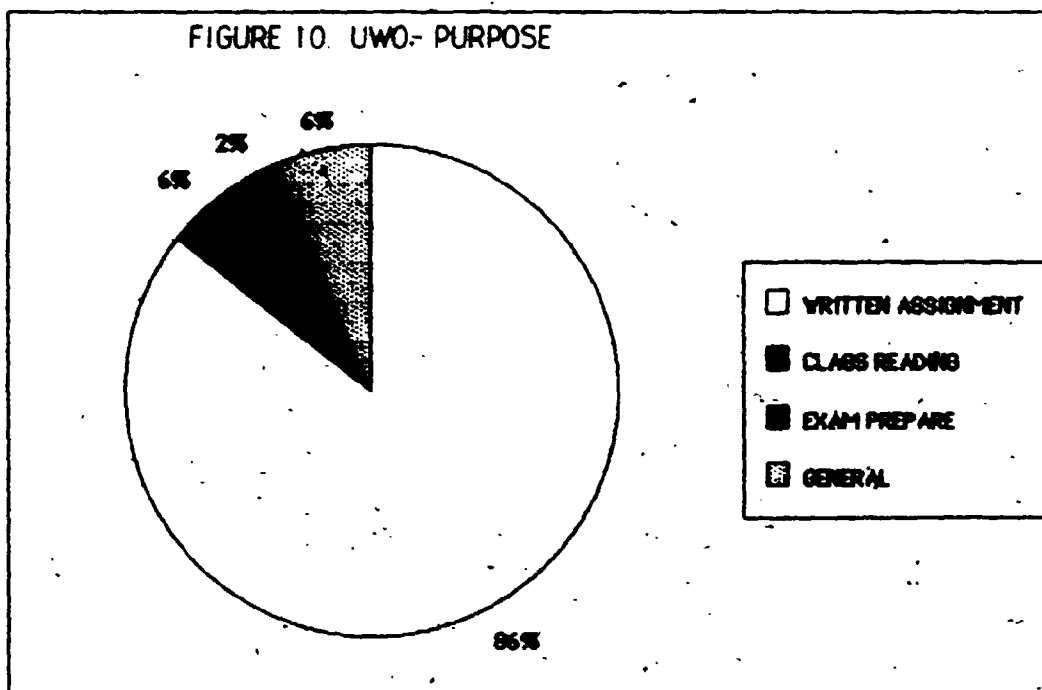
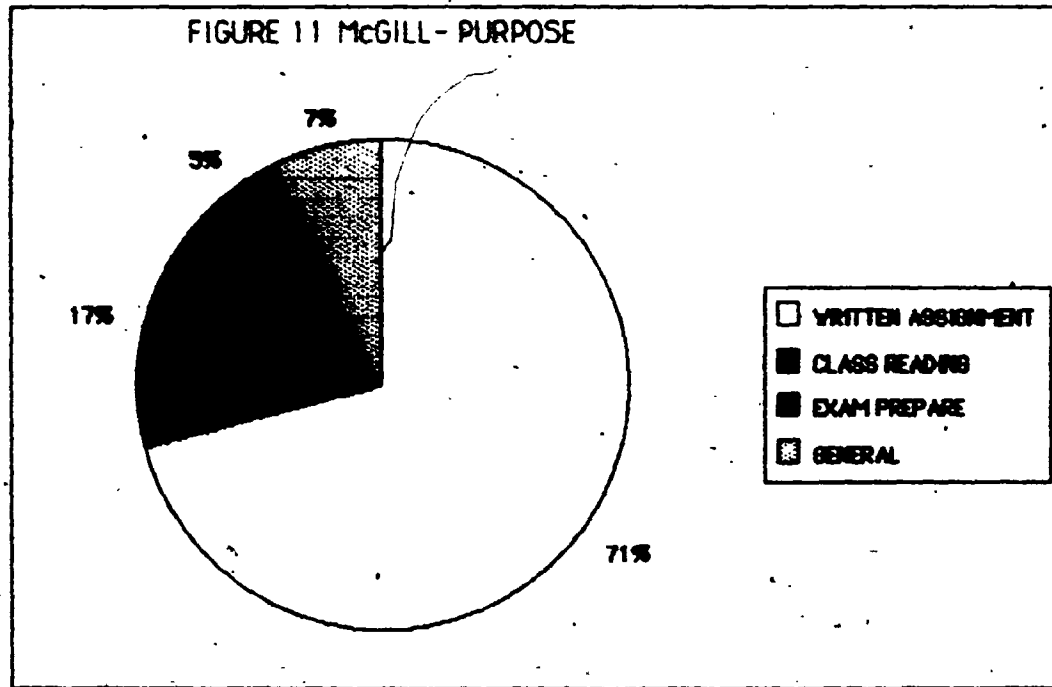
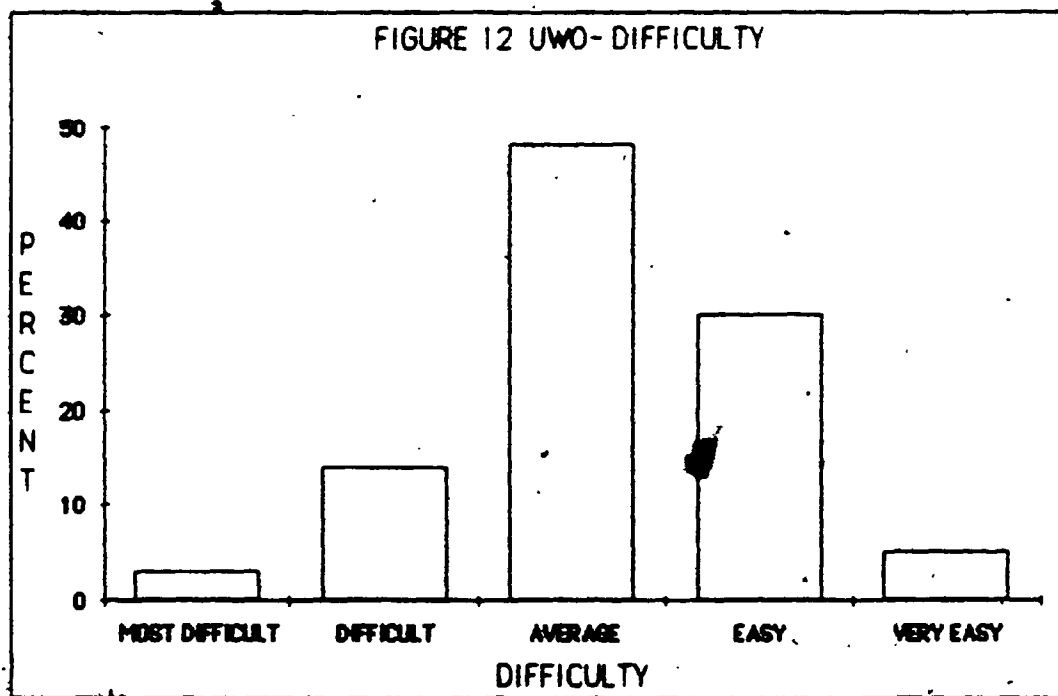
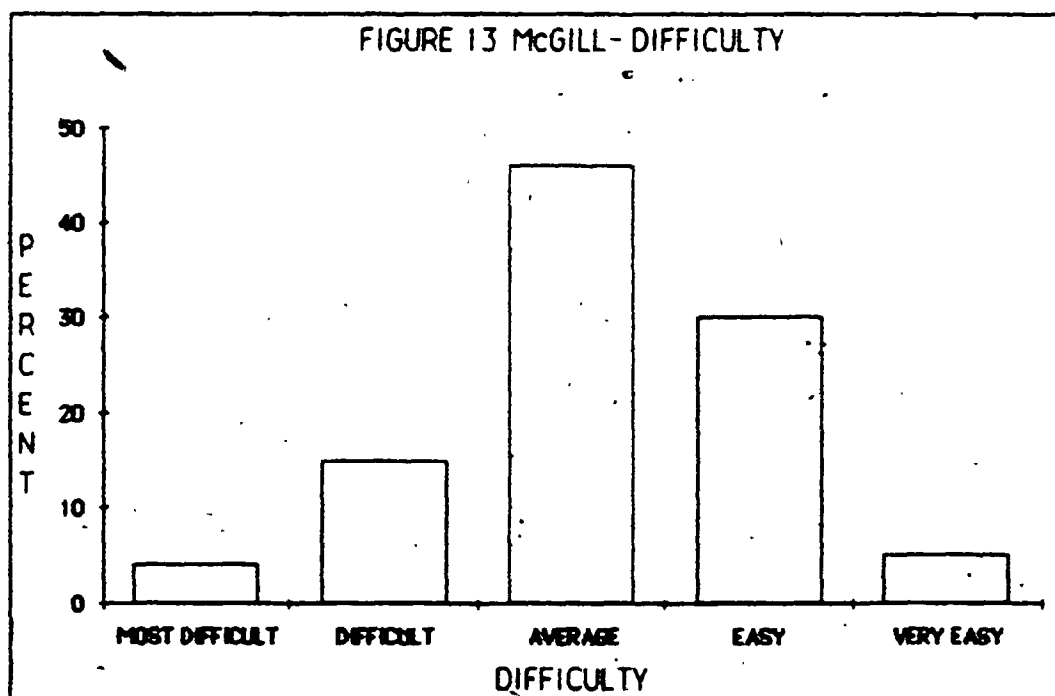
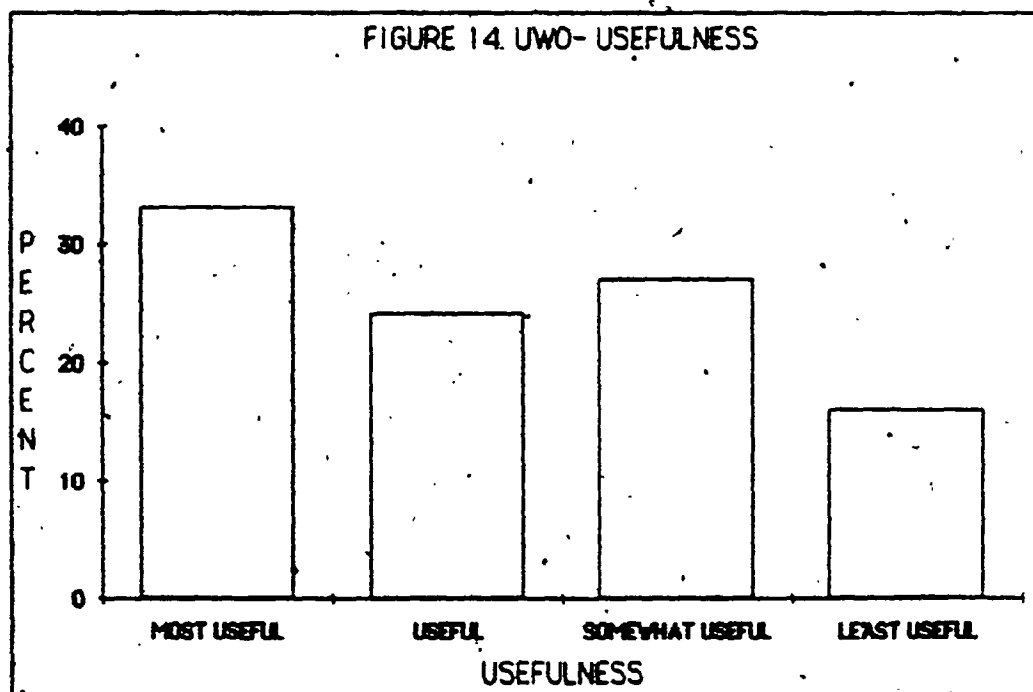


FIGURE 11 MCGILL - PURPOSE









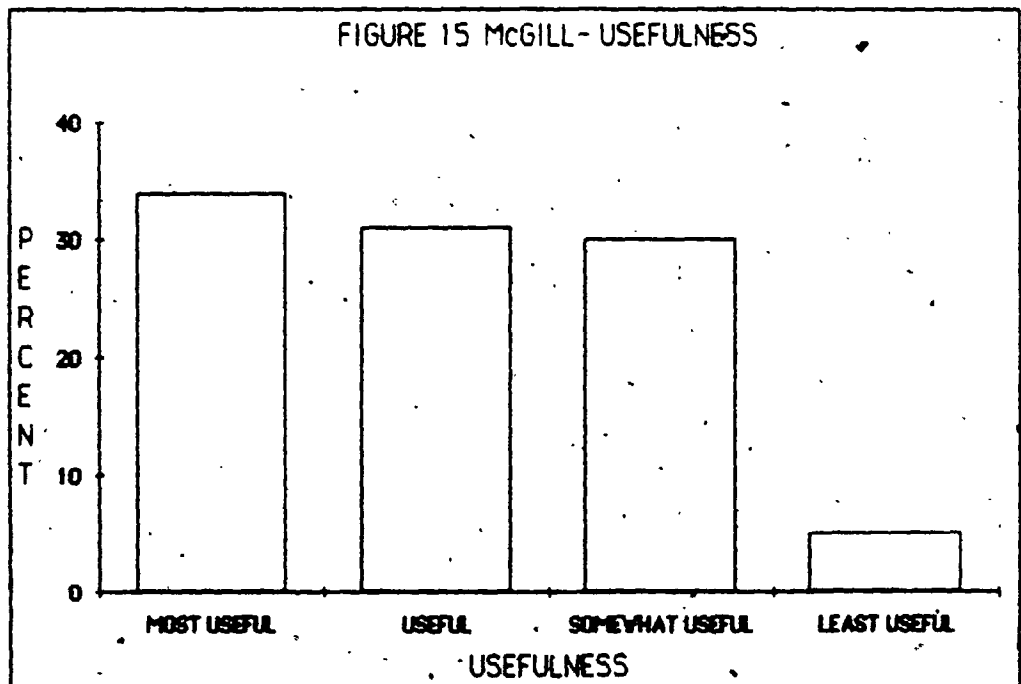


TABLE 34
SUBJECT CONCENTRATION OF BOOKS

UWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE BOOKSUB
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 7847.38	WITHIN MS 7109.68
SOCIAL SCI.	74	78.08		
ARTS	37	94.32	F VALLE	PROB>F
SCIENCE	43	66.28	1.10	0.3343

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
SOCIAL SCI.	74	5516.00	5735.00	273.36	74.54
ARTS	37	3302.00	2867.50	233.76	89.24
SCIENCE	43	3117.00	3332.50	245.45	72.49

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 3.51 DF= 2 PROB > CHISQ=0.1726

TABLE 35
 SUBJECT CONCENTRATION OF BOOKS
 MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE BOOKSUB
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			857.54	2987.77
SOCIAL SCI.	39	58.33		
ARTS	40	60.25	F VALUE	PROB>F
SCIENCE	24	68.75	0.29	0.7511

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
SOCIAL SCI.	39	2062.00	2028.00	144.99	52.87
ARTS	40	1901.00	2080.00	145.69	47.52
SCIENCE	24	1393.00	1248.00	126.37	58.04

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 1.97 DF= 2 PROB > CHISQ=0.3739

TABLE 36
PURPOSE FOR BORROWING

UWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE PURPOSE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
ASSIGNMENT	144	76.13	9114.95	6928.08
OTHER	18	100.00	F VALUE	PROB>F
			1.32	0.2531

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
ASSIGNMENT	144	11449.50	11736.00	185.57	79.51
OTHER	18	1753.50	1467.00	185.57	97.42

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
(WITH CONTINUITY CORRECTION OF .5)

S= 1753.50² Z= 1.5412 PROB > |Z|=0.1233

T-TEST APPROX. SIGNIFICANCE=0.1252

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 2.38 DF= 1 PROB > CHISQ=0.1226

TABLE 37

PURPOSE FOR BORROWING

MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE PURPOSE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			6644.01	2883.89
ASSIGNMENT	75	56.47		
OTHER	31	73.87	F VALLE	PROB>F
			2.30	0.1321

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
ASSIGNMENT	75	3691.00	4012.50	141.97	49.21
OTHER	31	1980.00	1658.50	141.97	63.87

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
(WITH CONTINUITY CORRECTION OF .9)

S= 1980.00 Z= 2.2611 PROB > |Z|=0.0238

T-TEST APPROX. SIGNIFICANCE=0.0258

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 5.13 DF= 1 PROB > CHISQ=0.0235

TABLE 38

SUBJECT CONCENTRATION OF COURSES

UWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE COURSE
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
SOCIAL SCI.	75	83.84	3421.32	6960.3
ARTS	37	78.51	F VALUE	PROB > F
SCIENCE	43	68.02	0.49	0.6126

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
SOCIAL SCI.	75	5898.50	5850.00	276.50	78.65
ARTS	37	3022.50	2886.00	235.87	81.69
SCIENCE	43	3169.00	3354.00	247.72	73.70

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 0.67 • DF= 2 PROB > CHISQ=0.7140

TABLE 39
 SUBJECT CONCENTRATION OF COURSES
 TWO DISCIPLINES
 MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE COURSE
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 12393	WITHIN MS 2920.79
ARTS	74	56.15		
SCIENCE	22	83.18	F VALUE 4.24	PROB > F 0.0422

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
ARTS	74	3291.50	3589.00	113.25	44.48
SCIENCE	22	1364.50	1067.00	113.25	62.02

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
 (WITH CONTINUITY CORRECTION OF .5)

S= 1364.50 Z= 2.6226 PROB > |Z|=0.0087

T-TEST APPROX. SIGNIFICANCE=0.0102

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 6.90 DF= 1 PROB > CHISQ=0.0086

TABLE 40
 SUBJECT CONCENTRATION OF COURSES
 THREE DISCIPLINES
 MCGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE COURSUB
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 6205.01	WITHIN MS 2952.02
SOCIAL SCI.	51	56.47		
ARTS	23	55.43	F VALUE	PROB>F
SCIENCE	22	83.18	2.10	0.1280

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H ₀	STD DEV UNDER H ₀	MEAN SCORE
SOCIAL SCI.	51	2334.50	2473.50	134.46	45.77
ARTS	23	957.00	1115.50	115.01	41.61
SCIENCE	22	1364.50	1067.00	113.25	62.02

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 7.26 DF= 2 PROB > CHISQ=0.0265

TABLE 41

DIFFICULTY

UWO

THREE CLASSIFICATIONS

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE DIFFICULTY
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

		N	MEAN	AMONG MS	WITHIN MS
				485.445	7139.2
MOST	2	27	77.04		
	3	67	82.81	F VALUE	PROB>F
LEAST	4	64	78.20	0.07	0.9343

WILCOXON SCORES (RANK SUMS)

		N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	2	27	1870.00	2146.50	214.16	69.26
	3	67	5588.50	5326.50	281.17	83.41
LEAST	4	64	5102.50	5088.00	279.30	79.73

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 1.88 DF= 2 PROB > CHISQ=0.3899

TABLE 42

USEFULNESS

UNO

THREE CLASSIFICATIONS

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE USEFUL
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

		N	MEAN	AMONG MS	WITHIN MS
				43994.5	6638.75
MOST	1	59	109.66		
	2	41	64.95	F VALUE	PROB>F
LEAST	3	55	57.91	6.63	0.0017

WILCOXON SCORES (RANK SUMS)

		N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	1	59	5664.50	4602.00	268.44	96.01
	2	41	3035.00	3198.00	243.85	74.02
LEAST	3	55	3390.50	4290.00	264.52	61.65

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 17.49 DF= 2 PROB > CHISQ=0.0002

TABLE 43

DIFFICULTY

MCGILL

THREE CLASSIFICATIONS

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE DIFFIC
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 4987.09	WITHIN MS 2879.55
MOST 2	21	79.76		
3	46	60.65	F VALUE	PROB > F
LEAST 4	39	52.82	1.73	0.1821

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST 2	21	1313.50	1123.50	124.39	62.55
3	46	2539.00	2461.00	154.68	55.20
LEAST 4	39	1818.50	2086.50	150.51	46.63

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)

CHISQ= 4.02 DF= 2 PROB > CHISQ=0.1341

TABLE 44

USEFULNESS

MCGILL

THREE CLASSIFICATIONS

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE USEFUL.
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
MOST 1	44	73.52	8563	2827.81
2	33	63.18	F VALUE	PROB > F
LEAST 3	28	41.96	3.03	0.0528

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST 1	44	2575.50	2332.00	151.87	58.53
2	33	1824.50	1749.00	142.89	55.29
LEAST 3	28	1165.00	1484.00	136.12	41.61

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 5.71 DF= 2 PROB > CHISQ=0.0575

TABLE 45

TIMES FOR NOTE TAKING

UWO

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE NOTES
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
NO	67	57.76	51347.5	6898.76
YES	86	94.69	F VALUE	PROB>F
			7.44	0.0071

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
NO	67	4272.00	5159.00	269.02	63.76
YES	86	7509.00	6622.00	269.02	87.31

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
 (WITH CONTINUITY CORRECTION OF .5)

S= 4272.00 Z=-3.2953 PROB >|Z|=0.0010

T-TEST APPROX. SIGNIFICANCE=0.0012

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 10.87 DF= 1 PROB > CHISQ=0.0010

TABLE 46
TIMES FOR NOTE TAKING

McGILL

ANALYSIS FOR VARIABLE TIME CLASSIFIED BY VARIABLE NOTES
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
NO	55	44.09	34871.5	2612.47
YES	51	80.39	F VALUE	PROB>F
			13.35	0.0004

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
NO	55	2371.00	2942.50	155.94	43.11
YES	51	3300.00	2728.50	155.94	64.71

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
(WITH CONTINUITY CORRECTION OF .5)

S= 3300.00 Z= 3.6617 PROB >|Z|=0.0003

T-TEST APPROX. SIGNIFICANCE=0.0004

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 13.43 DF= 1 PROB > CHISQ=0.0002

APPENDIX H

INDEPENDENT VARIABLES

TABLE 47

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

UWO

TABLE OF SUBJECT BY COURSE

SUBJECT	COURSE			TOTAL
	SOCIAL	ARTS	SCIENCE	
FREQUENCY				
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	159	11	2	172
SCIENCE	43.80	3.03	0.55	47.38
	92.44	6.40	1.16	
	87.85	13.41	2.00	
ARTS	15	69	4	88
	4.13	19.01	1.10	24.24
	17.05	78.41	4.55	
	8.29	84.15	4.00	
SCIENCE	7	2	94	103
	1.93	0.55	25.90	28.37
	6.80	1.94	91.26	
	3.87	2.44	94.00	
TOTAL	181	82	100	363
	49.86	22.59	27.55	100.00

STATISTICS FOR TABLE OF SUBJECT BY COURSE

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	492.796	0.000
LIKELIHOOD RATIO CHI-SQUARE	4	468.472	0.000
MANTEL-HAENSZEL CHI-SQUARE	1	274.746	0.000
PHI		1.165	
CONTINGENCY COEFFICIENT		0.759	
CRAMER'S V		0.824	

EFFECTIVE SAMPLE SIZE = 363

FREQUENCY MISSING = 30

TABLE 48

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

MCGILL

TABLE OF SUBJECT BY COURSE

SUBJECT	COURSE			
	SOCIAL	ARTS	SCIENCE	TOTAL
FREQUENCY				
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	91	8	6	105
SCI.	27.74	2.44	1.83	32.01
	86.67	7.62	5.71	
	65.47	7.77	6.98	
ARTS	29	95	13	137
	8.84	28.96	3.96	41.77
	21.17	69.34	9.49	
	20.86	92.23	15.12	
SCIENCE	19	0	67	86
	5.79	0.00	20.43	26.22
	22.09	0.00	77.91	
	13.67	0.00	77.91	
TOTAL	139	103	86	328
	42.38	31.40	26.22	100.00

STATISTICS FOR TABLE OF SUBJECT BY COURSE

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	299.306	0.000
LIKELIHOOD RATIO CHI-SQUARE	4	294.272	0.000
MANTEL-HAENSZEL CHI-SQUARE	1	134.311	0.000
PHI		0.955	
CONTINGENCY COEFFICIENT		0.691	
CRAMER'S V		0.675	

EFFECTIVE SAMPLE SIZE = 328
 FREQUENCY MISSING = 29

TABLE 49

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

UWO

TABLE OF SUBJECT BY PURPOSE

FREQUENCY PERCENT ROW PCT COL PCT	BOOKSUB		PURPOSE
	ASSIGNM	OTHER	TOTAL
SOCIAL	161	11	172
SCIENCE	42.37	2.89	45.26
	93.60	6.40	
	49.54	20.00	
ARTS	78	28	101
	19.21	7.37	26.58
	72.28	27.72	
	22.46	50.91	
SCIENCE	91	16	107
	23.95	4.21	28.16
	85.05	14.95	
	28.00	29.09	
TOTAL	325	55	380
	85.53	14.47	100.00

FREQUENCY MISSING = 13

STATISTICS FOR TABLE OF BOOKSUB BY PURPOSE

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	2	23.410	0.000
LIKELIHOOD RATIO CHI-SQUARE	2	22.935	0.000
MANTEL-HAENSZEL CHI-SQUARE	1	6.244	0.012
PHI		0.248	
CONTINGENCY COEFFICIENT		0.241	
CRAMER'S V		0.248	

EFFECTIVE SAMPLE SIZE = 380

TABLE 50

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

MCGILL

TABLE OF SUBJECT BY PURPOSE

SUBJECT	PURPOSE		
	ASSIGN	OTHER	TOTAL
FREQUENCY			
PERCENT			
ROW PCT			
COL PCT			
SOCIAL	75	35	110
SCIENCE	21.49	10.03	31.52
	68.18	31.82	
	30.74	33.33	
ARTS	105	39	144
	30.09	11.17	41.26
	72.92	27.08	
	43.03	37.14	
SCIENCE	64	31	95
	18.34	8.88	27.22
	67.37	32.63	
	26.23	29.52	
TOTAL	244	105	349
	69.91	30.09	100.00

STATISTICS FOR TABLE OF SUBJECT BY PURPOSE

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	2	1.067	0.587
LIKELIHOOD RATIO CHI-SQUARE	2	1.073	0.585
MANTEL-HAENSZEL CHI-SQUARE	1	0.006	0.938
PHI		0.055	
CONTINGENCY COEFFICIENT		0.055	
CRAMER'S V		0.055	

EFFECTIVE SAMPLE SIZE = 349

FREQUENCY MISSING = 8

TABLE 51

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

UWO

TABLE OF SUBJECT BY DIFFICULTY

SUBJECT	DIFFICULTY			TOTAL
	MOST	3	LEAST	
FREQUENCY	2	3	4	
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	21	82	60	163
SCIENCE	5.77	22.53	16.48	44.78
	12.88	50.31	36.81	
	33.87	46.86	47.24	
ARTS	16	48	35	99
	4.40	13.19	9.62	27.20
	16.16	48.48	35.35	
	25.81	27.43	27.56	
SCIENCE	25	45	32	102
	6.87	12.36	8.79	28.02
	24.51	44.12	31.37	
	40.32	25.71	25.20	
TOTAL	62	175	127	364
	17.03	48.08	34.89	100.00

STATISTICS FOR TABLE OF SUBJECT BY DIFFICULTY

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	6.084	0.193
LIKELIHOOD RATIO CHI-SQUARE	4	5.850	0.211
MANTEL-HAENSZEL CHI-SQUARE	1	3.578	0.059
PHI		0.129	
CONTINGENCY COEFFICIENT		0.128	
CRAMER'S Y		0.091	

EFFECTIVE SAMPLE SIZE = 364
 FREQUENCY MISSING = 29

TABLE 52

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

MCGILL

TABLE OF SUBJECT BY DIFFICULTY

SUBJECT	DIFFICULTY			TOTAL
	MOST		LEAST	
FREQUENCY	2	3	4	
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	16	44	20	80
SCIENCE	5.88	16.18	7.35	29.41
	20.00	55.00	25.00	
	32.65	35.20	20.41	
ARTS	16	44	56	116
	5.88	16.18	20.59	42.65
	13.79	37.93	48.28	
	32.65	35.20	57.14	
SCIENCE	17	37	22	76
	6.25	13.60	8.09	27.94
	22.37	48.68	28.95	
	34.69	29.60	22.45	
TOTAL	49	125	98	272
	18.01	45.96	36.03	100.00

STATISTICS FOR TABLE OF SUBJECT BY DIFFICULTY

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	13.882	0.008
LIKELIHOOD RATIO CHI-SQUARE	4	13.872	0.008
MANTEL-HAENSZEL CHI-SQUARE	1	0.037	0.847
PHI		0.226	
CONTINGENCY COEFFICIENT		0.220	
CRAMER'S V		0.160	

EFFECTIVE SAMPLE SIZE = 272

FREQUENCY MISSING = 85

TABLE 53

SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

UWO

TABLE OF SUBJECT BY USEFULNESS

SUBJECT	USEFUL			TOTAL
	1	2	3	
FREQUENCY				
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	49	38	75	162
SCIENCE	13.61	10.56	20.83	45.00
	30.25	23.46	46.30	
	41.18	43.68	48.70	
ARTS	35	28	34	97
	9.72	7.78	9.44	26.94
	36.08	28.87	35.05	
	29.41	32.18	22.08	
SCIENCE	35	21	45	101
	9.72	5.83	12.50	28.06
	34.65	20.79	44.55	
	29.41	24.14	29.22	
TOTAL	119	87	154	360
	33.06	24.17	42.78	100.00

STATISTICS FOR TABLE OF SUBJECT BY USEFULNESS

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	4.027	0.402
LIKELIHOOD RATIO CHI-SQUARE	4	4.077	0.396
MANTEL-HAENSZEL CHI-SQUARE	1	0.534	0.465
PHI		0.106	
CONTINGENCY COEFFICIENT		0.105	
CRAMER'S V		0.075	

EFFECTIVE SAMPLE SIZE = 360
 FREQUENCY MISSING = 33

TABLE 54
SUBJECT CONCENTRATION OF BOOKS VS OTHER VARIABLES

McGILL

TABLE OF SUBJECT BY USEFULNESS

SUBJECT	USEFUL			TOTAL
	1	2	3	
FREQUENCY				
PERCENT				
ROW PCT	MOST	LEAST		
COL PCT				
SOCIAL	20	36	23	79
SCIENCE	7.38	13.28	8.49	29.15
	25.32	45.57	29.11	
	22.47	41.86	23.96	
ARTS	41	26	49	116
	15.13	9.59	18.08	42.80
	35.34	22.41	42.24	
	46.07	30.23	51.04	
SCIENCE	28	24	24	76
	10.33	8.86	8.86	28.04
	36.84	31.58	31.58	
	31.46	27.91	25.00	
TOTAL	89	86	96	271
	32.84	31.73	35.42	100.00

STATISTICS FOR TABLE OF SUBJECT BY USEFUL

STATISTIC	DF	VALUE	P-VALUE
CHI-SQUARE	4	12.822	0.013
LIKELIHOOD RATIO CHI-SQUARE	4	12.496	0.014
MANTEL-HAENSZEL CHI-SQUARE	1	0.452	0.502
PHI		0.216	
CONTINGENCY COEFFICIENT		0.211	
CRAMER'S V		0.153	

EFFECTIVE SAMPLE SIZE = 271
FREQUENCY MISSING = 86

TABLE 55

SUBJECT CONCENTRATION OF COURSES VS OTHER VARIABLES

UWO

TABLE OF COURSE BY DIFFICULTY

COURSE	DIFFICULTY			TOTAL
	MOST		LEAST	
FREQUENCY:				
PERCENT				
ROW PCT	2	3	4	
COL PCT				
SOCIAL	24	90	62	176
SCIENCE	6.63	24.86	17.13	48.62
	13.64	51.14	35.23	
	39.34	51.14	49.60	
ARTS	14	39	31	84
	3.87	10.77	8.56	23.20
	16.67	46.43	36.90	
	22.95	22.16	24.80	
SCIENCE	23	47	32	102
	6.35	12.98	8.84	28.18
	22.55	46.08	31.37	
	37.70	26.70	25.60	
TOTAL	61	176	125	362
	16.85	48.62	34.53	100.00

STATISTICS FOR TABLE OF COURSE BY DIFFICULTY

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	3.950	0.413
LIKELIHOOD RATIO CHI-SQUARE	4	3.842	0.428
MANTEL-HAENSZEL CHI-SQUARE	1	1.992	0.158
PHI		0.104	
CONTINGENCY COEFFICIENT		0.104	
CRAMER'S V		0.074	

EFFECTIVE SAMPLE SIZE = 362

FREQUENCY MISSING = 31

TABLE 56

SUBJECT CONCENTRATION OF COURSES VS OTHER VARIABLES

MCGILL

TABLE OF COURSE BY DIFFICULTY

COURSE	DIFFICULTY				TOTAL
	MOST	2	3	LEAST	
FREQUENCY					
PERCENT					
ROW PCT					
COL PCT					
SOCIAL	24	58	31		113
SCIENCE	9.23	22.31	11.92		43.46
	21.24	51.33	27.43		
	48.00	46.40	36.47		
ARTS	10	35	34		79
	3.85	13.46	13.08		30.38
	12.66	44.30	43.04		
	20.00	28.00	40.00		
SCIENCE	16	32	20		68
	6.15	12.31	7.69		26.15
	23.53	47.06	29.41		
	32.00	25.60	23.53		
TOTAL	50	125	85		260
	19.23	48.08	32.69		100.00

STATISTICS FOR TABLE OF COURSE BY DIFFICULTY

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	6.928	0.140
LIKELIHOOD RATIO CHI-SQUARE	4	6.951	0.139
MANTEL-HAENSZEL CHI-SQUARE	1	0.107	0.743
PHI		0.163	
CONTINGENCY COEFFICIENT		0.161	
CRAMER'S V		0.115	

EFFECTIVE SAMPLE SIZE = 260
 FREQUENCY MISSING = 97

TABLE 57

SUBJECT CONCENTRATION OF COURSES VS OTHER VARIABLES

UNO

TABLE OF COURSE BY USEFULNESS

COURSE	USEFUL			TOTAL
	MOST		LEAST	
FREQUENCY:	1	2	3	
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	49	43	82	174
SCIENCE	13.61	11.94	22.78	48.33
	28.16	24.71	47.13	
	40.83	52.44	51.90	
ARTS	33	20	31	84
	9.17	5.56	8.61	23.33
	39.29	23.81	36.90	
	27.50	24.39	19.62	
SCIENCE	38	19	45	102
	10.56	5.28	12.50	28.33
	37.25	18.63	44.12	
	31.67	23.17	28.48	
TOTAL	120	82	158	360
	33.33	22.78	43.89	100.00

STATISTICS FOR TABLE OF COURSE BY USEFULNESS

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	5.207	0.267
LIKELIHOOD RATIO CHI-SQUARE	4	5.306	0.257
MANTEL-HAENSZEL CHI-SQUARE	1	1.696	0.193
PHI		0.120	
CONTINGENCY COEFFICIENT		0.119	
CRAMER'S V		0.085	

EFFECTIVE SAMPLE SIZE = 360
 FREQUENCY MISSING = 33

TABLE 58

SUBJECT CONCENTRATION OF COURSES VS OTHER VARIABLES

MCGILL

TABLE OF COURSE BY USEFULNESS

COURSE	USEFUL			TOTAL
	MOST		LEAST	
FREQUENCY	1	2	3	
PERCENT				
ROW PCT				
COL PCT				
SOCIAL	32	41	39	112
SCIENCE	12.36	15.83	15.06	43.24
	28.57	36.61	34.82	
	36.78	50.62	42.86	
ARTS	31	17	31	79
	11.97	6.56	11.97	30.50
	39.24	21.52	39.24	
	35.63	20.99	34.07	
SCIENCE	24	23	21	68
	9.27	8.88	8.11	26.25
	35.29	33.82	30.88	
	27.59	28.40	23.08	
TOTAL	87	81	91	259
	33.59	31.27	35.14	100.00

STATISTICS FOR TABLE OF COURSE BY USEFUL

STATISTIC	DF	VALUE	PROB
CHI-SQUARE	4	5.945	0.203
LIKELIHOOD RATIO CHI-SQUARE	4	6.193	0.185
MANTEL-HAENSZEL CHI-SQUARE	1	0.730	0.393
PHI		0.152	
CONTINGENCY COEFFICIENT		0.150	
CRAMER'S V		0.107	

EFFECTIVE SAMPLE SIZE = 259

FREQUENCY MISSING = 98

TABLE 59

RETENTION PERIOD AND SUBJECT CONCENTRATION OF BOOKS

McGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE SUBJECT
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
SOCIAL SCI.	110	8.90	403.799	80.0621
ARTS	144	11.67	F VALUE	PROB > F
SCIENCE	93	8.17	5.04	0.0069

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
SOCIAL SCI.	110	18290.00	19140.00	867.05	166.27
ARTS	144	27784.50	25056.00	918.13	192.95
SCIENCE	93	14303.50	16182.00	825.34	153.80

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 9.61 DF= 2 PROB > CHISQ=0.0082

TABLE 60

RETENTION PERIOD AND SUBJECT CONCENTRATION OF BOOKS

LWO

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE BOOKSUB
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			108.919	296.154
SOCIAL SCI.	170	18.92		
ARTS	101	17.42	F VALUE	PROB>F
SCIENCE	106	17.38	0.37	0.6925

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
SOCIAL SCI.	170	33292.50	32130.00	1051.91	195.84
ARTS	101	20086.00	19089.00	936.23	198.87
SCIENCE	106	17874.50	20034.00	950.40	168.63

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 5.21 DF= 2 PROB > CHISQ=0.0738

TABLE 61

RETENTION PERIOD AND SUBJECT CONCENTRATION OF COURSES

UWO

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE COURSUB
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			5.9067	299.757
SOCIAL SCI.	182	18.06		
ARTS	87	17.63	F VALUE	PROB>F
SCIENCE	103	18.04	0.02	0.9805

WILCOXON SCORES (RANK-SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
SOCIAL SCI.	182	34704.00	33943.00	1035.79	190.68
ARTS	87	16977.50	16225.50	877.08	195.14
SCIENCE	103	17696.50	19209.50	927.16	171.81

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 2.76 DF= 2 PROB > CHISQ=0.2510

TABLE 62

RETENTION PERIOD AND SUBJECT CONCENTRATION OF COURSES

MCGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE COURSE

AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
SOCIAL SCI.	145	8.35	630.005	81.3646
ARTS	105	12.79	F VALUE	PROB>F
SCIENCE	84	9.24	7.74	0.0005

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
SOCIAL SCI.	145	21749.00	24287.50	872.13	149.99
ARTS	105	21269.50	17587.50	816.92	202.57
SCIENCE	84	12926.50	14070.00	763.44	153.89

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 20.40 DF= 2 PROB > CHISQ=0.0001

3

3

MICROCOPY RESOLUTION TEST CHART
NBS - 1010a
(ANSI and ISO TEST CHART No. 2)

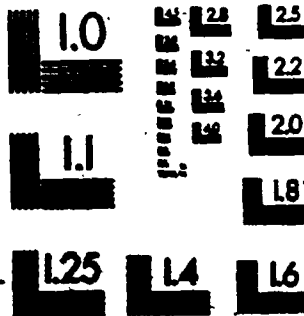


TABLE 63

RETENTION PERIOD AND PURPOSE

UWO

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE PURPOSE
 AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 835.884	WITHIN MS 288.996
ASSIGNMENT	335	17.15		
OTHER	54	21.39	F VALUE 2.89	PROB>F 0.0898

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
ASSIGNMENT	335	63074.50	65325.00	766.05	188.28
OTHER	54	12780.50	10530.00	766.05	236.68

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
 (WITH CONTINUITY CORRECTION OF .5)

S=12780.50 Z= 2.9371 PROB >|Z|=0.0033

T-TEST APPROX. SIGNIFICANCE=0.0035

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
 CHISQ= 8.63 DF= 1 PROB > CHISQ=0.0033

TABLE 64
RETENTION PERIOD AND PURPOSE

McGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE PURPOSE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 3.79486	WITHIN MS 81.3547
ASSIGNMENT	249	9.73		
OTHER	106	9.95	F VALUE 0.05	PROB>F 0.8291

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
ASSIGNMENT	249	44814.50	44322.00	882.46	179.98
OTHER	106	18375.50	18868.00	882.46	173.35

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
(WITH CONTINUITY CORRECTION OF .5)

S=18375.50 Z=-0.5575 \ PROB > |Z|=0.5772

T-TEST APPROX. SIGNIFICANCE=0.5775

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 0.31 DF= 1 PROB > CHISQ=0.5768

TABLE 65
RETENTION PERIOD AND DIFFICULTY

UNO

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE DIFFICULTY

AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

		N	MEAN	AMONG MS	WITHIN MS
MOST	1	10	16.50	24.6159	296.58
	2	52	19.13		
	3	179	18.00	F VALUE	PROB>F
	4	112	18.51	0.08	0.9876
LEAST	5	20	17.60		

WILCOXON SCORES (RANK SUMS)

		N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	1	10	1901.00	1870.00	336.06	190.10
	2	52	9166.00	9724.00	720.64	176.27
	3	179	34891.00	33473.00	1039.43	194.92
	4	112	20335.50	20944.00	953.67	181.57
LEAST	5	20	3457.50	3740.00	468.67	172.88

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 2.12 DF= 4 PROB > CHISQ=0.7135

TABLE 66
RETENTION PERIOD AND DIFFICULTY

McGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE DIFFIC
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

		N	MEAN	AMONG MS	WITHIN MS
				124.101	83.8499
MOST	1	10	12.40		
	2	41	12.98	F VALUE	PROB>F
	3	128	9.54	1.48	0.2084
	4	83	11.14		
LEAST	5	15	8.53		

WILCOXON SCORES (RANK SUMS)

		N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	1	10	1400.00	1390.00	247.97	140.00
	2	41	6296.00	5699.00	472.05	153.56
	3	128	16991.50	17792.00	662.73	132.75
	4	83	11816.00	11537.00	608.94	142.36
LEAST	5	15	1999.50	2085.00	300.84	133.30

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 2.37 DF= 4 PROB > CHISQ=0.6676

TABLE 67
RETENTION PERIOD AND USEFULNESS

UWO

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE USEFUL

AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS	WITHIN MS
			108.919	294.978
MOST	1 124	17.10		
	2 87	18.70	F VALUE	PROB>F
	3 97	19.33	0.37	0.7782
LEAST	4 61	19.07		

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	1 124	22386.00	22940.00	967.00	180.53
	2 87	15412.50	16095.00	869.00	177.16
	3 97	18680.00	17945.00	901.17	192.58
LEAST	4 61	11786.50	11285.00	760.46	193.22

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 1.54 DF= 3 PROB > CHISQ=0.6725

TABLE 68
RETENTION PERIOD AND USEFULNESS

MCGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE USEFUL
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

		N	MEAN	AMONG MS 54.7767	WITHIN MS 84.7323
MOST	1	93	11.54	F VALUE 0.65	PROB>F 0.5897
	2	86	10.24		
	3	82	9.77		
LEAST	4	15	11.60		

WILCOXON SCORES (RANK SUMS)

		N	SUM OF SCORES	EXPECTED UNDER H0	STD DEV UNDER H0	MEAN SCORE
MOST	1	93	13292.00	12880.50	624.90	142.92
	2	86	11735.00	11911.00	612.31	136.45
	3	82	10758.00	11357.00	604.16	131.20
LEAST	4	15	2441.00	2077.50	299.72	162.73

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 2.43 DF= 3 PROB > CHISQ=0.4888

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TABLE 64
RETENTION PERIOD AND PURPOSE
MCGILL

ANALYSIS FOR VARIABLE LENGTH CLASSIFIED BY VARIABLE PURPOSE
AVERAGE SCORES WERE USED FOR TIES

ANALYSIS OF VARIANCE

	N	MEAN	AMONG MS 3.79486	WITHIN MS 81.3547
ASSIGNMENT	249	9.73		
OTHER	106	9.95	F VALUE 0.05	PROB>F 0.8291

WILCOXON SCORES (RANK SUMS)

	N	SUM OF SCORES	EXPECTED UNDER HO	STD DEV UNDER HO	MEAN SCORE
ASSIGNMENT	249	44814.50	44322.00	882.46	179.98
OTHER	106	18375.50	18868.00	882.46	173.35

WILCOXON 2-SAMPLE TEST (NORMAL APPROXIMATION)
(WITH CONTINUITY CORRECTION OF .5)

S=18375.50 Z=-0.5575 PROB >|Z|=0.5772

T-TEST APPROX. SIGNIFICANCE=0.5775

KRUSKAL-WALLIS TEST (CHI-SQUARE APPROXIMATION)
CHISQ= 0.31 DF= 1 PROB > CHISQ=0.5768