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Reference Use Statistics: Statistical Sampling Method Works (University of Tennessee at Chattanooga)

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While librarians at the reference desk find themselves even busier than before helping the patrons with their information needs, the reference desk statistics show a decline in the number of patrons served. In 1997-1998 the Reference department at University of Tennessee at Chattanooga (UTC) handled 17,132 questions. In 2000-2001 academic years the number had dropped to 12,068 questions. During the years 2002-2003 and 2003-2004, number of reference questions has increased a little to about 14,585 and 15,754, but not to the same level as 1997-1998. This decline is consistent with the nationwide trend reported in the Chronicle of Higher Education indicating that students are deserting campus libraries to work online from home. The statistics also support students' preference for electronic resources rather than traditional print library resources (Carlson, 2001). Kyrillidou & Young (2001-2002) voiced a variety of explanations for the decline in the number of reference transactions. The most important of those reasons was that the desk statistics reflect only one aspect of reference service in a university library. Jim Rettig of the University of Richmond expressed a similar concern saying that the "Desk-centric reference statistics fail to take into account all the modes through which we currently deliver reference service" (2004, 7). Other aspects of reference service are the time spent by the reference librarians in providing instruction in the use of online catalog, databases, e-journals, and other electronic resources in a classroom and to individuals remotely by phone or email. This involves instruction in computer use as well as information retrieval techniques. All these activities take a substantial amount of a reference librarian's time and training.

Most reference librarians would like reference statistics to reflect all aspects of reference work.

They would also like the task of keeping statistics to be simple. However, there is nothing simple about reference service. While spending more and more time helping individual students at their workstations, away from the reference desk, reference librarians still have to remember to mark statistics when they return to the reference desk. They realize that detailed information as to the type of questions asked at the desk would be helpful in guiding librarians while providing user instruction. Such details would also provide information on the impact of resource changes and technology in the library. However, the librarians do not have time to collect such detailed statistics while serving the patrons. They feel that helping the patron is more important than marking statistics on the sheet. As a result many questions go as unmarked. Traditional counting methods do not reflect what resources are most helpful or which formats require increased time with users.

Kesselman and Watstein state that the back-bone of statistical reporting should no longer be the collection of basic and routine statistics on a day-to-day basis. Instead, the heart of the new system should be a series of sample statistics to be collected at various times throughout the year that reflect high, medium, and low usage (1987, 27). Forty-four other university librarians polled by Tenopir also suggested that the reference statistics should be collected randomly rather than continuously (1998, 32).

UTC Library at a glance

During the last decade a number of electronic resources have been added to the UTC Lupton Library's collection which are accessible to the patrons in the library as well as via their home, office, campus laboratories or dorms and via wireless computers. Fifty-eight public access

terminals are housed in the UTC Lupton Library as well as an instruction classroom equipped with computers to teach 25 students simultaneously. Library instruction and orientation is offered on a one-on-one basis, as well as through regularly scheduled class sessions. Printed and on-line guides are also used as instruction tools. Raising the level of computer skills of each patron so that they may use online resources efficiently is the goal of all instruction/reference librarians. Though a librarian's job is not to teach students computer skills, but rather to improve their information literacy and research skills, librarians must ensure that students know how to retrieve information from the library resources efficiently. Demand for library user education has been increasing every year. During the year 2001-2002, the number of library instruction classes taught at UTC totaled 241, and the number of students who attended these classes was about 5,000 (out of a total enrollment of about 8,500). During 2002-2003 however, the number of such classes taught was 281, and the number of students who attended those classes was 5,582. The number of known database searches in the 92 databases to which library subscribes was 409,141 for the year 2002-2003. Off campus use of library resources is not yet tracked. Librarians have deliberately instituted initiatives for direct contact between the subject specialist librarians and the academic departments. Librarians are spending more time with faculty, staff, and students coaching them on the effective use of various resources pertinent to their specialty.

Justification of Sampling Method

Up until 2001, the librarians at the reference desk were expected to record every patron question with a tally mark every day that the library was open. At busy times the librarians found it practically impossible to record every single question and many questions went unrecorded. Also, considerable differences existed in the interpretation of the basic categories of questions. By 2002 the reference librarians favored a new approach to record reference statistics. In the summer of 2002-2003, a literature search was conducted to determine which other universities were using or were exploring the possibility of collecting refer-

ence statistics by a random sampling method. The following is the review of the literature search.

Literature Search

Louisiana State University (LSU)

Louisiana State University originally collected statistics by both the question type (e.g.: information, reference, research, and online catalog training, etc.); and by the patron type (e.g.: faculty, graduate, undergraduate student, and others). LSU librarians were not satisfied with the procedure because it hindered the reference service during peak hours and many of the transactions went unrecorded. Considerable differences also existed in the interpretation of the basic question categories. Librarians wanted to try a new system which would collect statistics in a more scientific and statistically sound manner, while freeing the desk staff to concentrate on the information needs of the patrons. In 1986, in consultation with the statistics department, they decided to try a random sampling method for gathering statistics. A 90% confidence level and an error range of 10% were deemed acceptable for the total number of questions asked during the year. Based on the previous year's data and a standard statistical equation, the size of a random sample was determined. Data was collected for a randomly distributed 60 hours of 4,103 total service hours during the year 1986. At the end of the year the figures from all the data collections were totaled and extrapolated to calculate the total number of questions. The final analysis showed an error rate of 11.23% which was very close to the desired 10%. The new approach was considered far more reliable and statistically valid than the old approach. While the error level could likely be reduced by increasing the sample size, the library administration decided that the level of accuracy was sufficient. To avoid delaying service to the patrons, trained graduate assistants recorded statistics on the designated days. With small modifications, the sampling approach has been highly successful at LSU. The reference staff appreciated the release time from recording all transactions and reported some improvement in interaction with the patrons (Maxstadt, 1988).

University of Tennessee at Knoxville (UTK)

In 1998, Carol Tenopir at the University of Tennessee at Knoxville surveyed 44 university reference librarians who estimated for her the percentage of reference questions answered by the variety of the resources available to them. Her categories were online catalog, print sources, CD-ROM, world-wide-web (www), commercial online sources, telephone, & listservs. While filling out her survey, some of the librarians pointed out that they rarely use only one source or even one medium to answer a question. Others said that they subscribed to a number of electronic resources through the internet which were used to answer reference questions along with the standard print sources. In Tenopir's survey of the 44 libraries however, the highest numbers of questions were answered with the help of online catalog, followed closely by the print collection. Tenopir surmised that patrons likely ask the librarians questions which they think can be answered by the resources they associate with libraries; and librarians also turn first to familiar resources. Jim Rettig's study also rated the local OPAC as the number one reference source followed by OCLC's World Cat (2004, 8). Although in Tenopir's survey the world-wide-web was used to answer only 10% of reference questions, the impression of the librarians is that many more patrons turn to the web first. Teaching students to search the web skillfully takes a lot of reference instructional time. The reference interview also takes longer as the librarian needs to know the level of computer skills and what print and online sources they have checked already, in addition to the typical questions about the topic, and the purpose of the search, etc. According to Tenopir, "Librarians will continue to take longer, go further to find answers, and instruct users on new technologies" (1998, 34). Since busy librarians do not have time to collect detailed statistics which can help them plan the services better, Tenopir suggests it is better to collect statistics randomly rather than continuously.

New York University

Kesselman and Watstein reported that the statistics task force at the New York University Bobst

Library compiled records of weekly reference transactions in 1986. These totals were recorded, and then the weeks were divided into high, medium and low groups depending on the total number of questions asked each week. The mean and standard of deviation were calculated for each group and, after setting a 95% confidence limit and an error rate of plus or minus 400, a sample size was set. The task force determined that they would sample five low use weeks, seven medium use weeks and three high use weeks. Then the weeks in the academic year under study were numbered consecutively and assigned a usage status based on the corresponding week in the previous year. Specific weeks to be sampled were chosen using a table of random numbers. After recording reference statistics on all the sample weeks, means were calculated for each usage group that were then multiplied by the total number of weeks in each group for the entire year. The product of the means and total number of weeks from each usage group were added to obtain the number of total transactions.

The sample statistics thus collected had the potential to supply detailed statistics to satisfy internal and external data communication needs at all levels. The new system helped personnel to categorize and record transactions better. Certain housekeeping duties were added, such as distributing statistics forms, and reminding the staff of the days on which statistics were to be kept. However, on the plus side, reference personnel experienced a greater awareness of not only statistical concepts, but also of the role, practice, problems, and potential of reference statistics (1987).

University of South Carolina at Columbia

The University of South Carolina reviewed and used the University of New York Bobst Library's sampling method. However, while studying sampling techniques for collecting reference statistics, they tested a correlation method for calculating reference statistics by using the number of people entering the library (door-count). The resulting correlation coefficient between the two variables was used to calculate weekly reference statistics for the nonsampled weeks. The sum of

the calculated weekly values and the actual values of the sampled weeks yielded an annual total of reference transactions that was comparable to the annual total determined by using the sampling technique. They concluded that the correlation method might offer libraries an accurate and less time-consuming procedure for keeping reference statistics (Lochstet and Lehman, 1999).

University of South Carolina at Spartanburg

The Reference librarians at the University of South Carolina, Spartanburg recently revised the categories into which reference statistics are divided. While eliminating the categories "Research" and "Ready Reference" they substituted a complexity of scale (simple, average, complex) for reference questions. They also changed the categories to library direction, campus direction and added options for question "location" (In-Library, Phone, office). They also converted the paper & clipboard format into the Microsoft Access database with an eye to minimizing the work involved in data analysis by Excel later on (Greben 2003).

Central Michigan University:

The Northern Virginia office of Central Michigan University's (CMU) Off-campus Library Services' Program analyzed reference questions using the Statistical Package for Social Sciences (SPSS/PC + Student ware). The results provided totals for each variable examined; for example; the subject of request, gender of requester, student or faculty. Also included were tables showing relationships among variables, e.g.: breakdown of subject of questions by course, search strategy, etc., with accompanying statistics. They found that such analyses gave a more precise picture of what is happening at the reference desk, and also provided information useful in planning reference services. The CMU experience is presented in a manner that any library can adapt to meet its needs if they want to keep such in-depth statistics (Witucke and Schumer, 1991).

Loughborough University (United Kingdom)

The library and information unit of the Loughborough University surveyed their own database of the public libraries. These data are collected annually by the chartered Institute of Public and Financial Accountants. According to this study most public libraries collect statistics for one week a year, during October. Weekly figures are multiplied by 50.2 to get the annual totals. The administrators provided each library with definitions of the terms and a list of specific examples of questions of the type of inquiries made at the reference desk. Such examples of what constitute inquiries or possible inquiries, and how they are classified was definitely helpful to the staff. The publicity of services, training the staff to record accurate statistics, and monitoring the recording were considered very important. In order to maintain integrity of the statistics, the authors recommended a vigorous and effective policing of sample statistics count. The researchers found a need to establish more clearly the type of information needs satisfied by public libraries of different size and location, to establish trends. Such services should also keep in mind alternative information providers in the area (Sumsion, et al, 1995).

New Zealand Public Library System

The New Zealand Public Library System gathers statistics using a random sampling technique for selected days. Cullen & Grey defined a service point as any branch, mobile unit or service point in the Central Library dealing with inquiries. A stratified single cluster sampling methodology was used, where a simple random sample of clusters (hours) was taken, and all transactions within the cluster sampled, for each service point. They recommended that a team of at least two trained persons (with an additional two trained as a back-up to cope with sickness or periods of leave) should be able to cope with routine sampling of 350 hours per year in a library of their size. One person would be required for most sample periods and a second person would be required during the peak times. Appendix A lists the categories of reference inquiries divided into

levels such as directional, quick reference, and research inquiries, with some examples. Appendix B reports the monthly variances/relative variances of logged enquiries. According to Cullen and Gray the task of gathering statistics requires training, familiarity with specifications, and management of the data, (1995).

Cullen and Gray's realization (similar to Maxstadt's conclusion) that at a busy service point it is difficult to focus adequately on reader inquiries and gather accurate statistics at the same led them to conclude that an assistant should be trained to help with the task of keeping statistics. Their clear definitions of the categories of reference inquiries with examples were helpful while planning the UTC study.

University of Tennessee at Chattanooga Study: Methodology

A report of the literature review was presented to the reference faculty at the end of the summer session, 2002. An analysis of the latest trends from the literature review, along with a perception of increased load at the reference desk, and the desire that reference statistics should accurately reflect the use of the reference staff's time, the reference faculty at UTC decided to test a random sampling method during 2002-2003. After gathering statistics by the random sampling method for one year, the results would be compared with the daily statistics collected during 2001-2002. If the sampling method proved satisfactory, the department planned to gather statistics by the random sampling method in the following years as well. Using the examples of other libraries studied, the type and category of questions posed at the reference desk were classified into two categories as follows:

Internal Users and External Users (telephone, email, online, etc.) Under each of the above users categories there were three subdivisions according to the type of question and some measure of time taken to answer the question: 1) Directional, 2) Less than 5 minutes, 3) More than 5 minutes. Following the examples of Maxstadt and Cullen and Grey, these categories were further clarified by listing examples of the type of questions to be included in each as elaborated below:

Directional Enquiries were to include: Non-bibliographic; basic directional and not library-specific questions; e.g. where are the photocopiers, or rest rooms or the reserve books, guest user login, etc.

Quick Reference (less than 5 minutes) Library skills used; involves using the collection. Includes: "what have you got on...?" helping them with the online-catalog, author/title search, simple database search, etc.

Research (More than 5 minutes): Involves skills plus time and often some organization of material retrieved. Uses professional judgment; utilizes a variety of skills; often involves the librarian doing some of the work for the client. Includes online database searching, subject or serials searches (Cullen and Gray, 1995).

Due to the cyclical nature of the level of patron use of reference services during the year, a stratified random sampling procedure was developed. By using the actual data for 2001-2002 for the number of patrons assisted at the reference desk, a standard of deviation was calculated for the entire year and also for each term. A confidence level of 95% and an acceptable error of ± 5 patrons were chosen (Table 1).

Analysis of the number of reference enquiries received during 2001-2002

Table 1

Column1	Yearly 2001-2002	Fall 2001-2002	Spring 2001-2002	Summer 2001-2002
Mean	38.14	41.73	47.01	21.86
Standard Error	1.55	2.95	2.60	1.56
Median	33	35.5	44	22
Mode	0	0	0	0
Standard Deviation*	29.56	33.16	28.39	14.87
Sample Variance	873.73	1099.76	806.036	221.28
Kurtosis	-0.34	-0.89	-0.68	-0.74
Skewness	0.68	0.43	0.28	0.25
Range	125	120	122	58
Minimum	0	0	0	0
Maximum	125	120	122	58
Sum	13884	5258	5595	1989
Count	364	126	119	91
Confidence Level (95.0%)	3.05	5.85	5.15	3.09

(* Standard of deviation is based on daily count)

Table 2

Required Sample size for the Number of days /Random Sampling of Patrons Reference Department/UTC Lupton Library 2002-2003

95% confidence level

$$\sigma = .05 \text{ Error} = \pm 5 \text{ patrons}$$

$$n = \frac{(1.96 * 29.55)}{5} * 136 \text{ days of sampling}$$

n = total sample size, σ = the standard of deviation, n_i = the stratum sample size for the i th stratum

N_i = the size of the i th stratum σ_i = the standard of deviation for the i th stratum

Since the cycles in the number of patrons served clearly (and logically) coincided with the school term, the data was divided into three strata: the spring, summer and fall terms. Using standard of deviation for each stratum, the number of sampling days needed in each stratum (term) was calculated.

Table 3
Number of Days for Collecting Statistics during Each Semester
2002-2003

Term	Ni	σ_i	Ni * σ_i	# of Sampling days 2002-3
Fall	126	33.16	4178.16	$(126*33.16)/8909.74*136 = 64$ days
Summer	91	14.87	1353.17	$(91*14.87)/8909.74*136 = 21$ days
Spring	119	28.39	3378.41	$(119*28.39)/8909.74*136 = 52$ days
Sum of Semesters			8909.74	

Table 3 shows that the number of calculated sampling days (within a 95% confidence interval).

Once the number of days of sampling needed for each period had been determined, a randomized sampling schedule was developed using a random number table. All days on which the library was open throughout the year were numbered consecutively and the days throughout the year for which statistics were to be kept were calculated. For the fall 2002, of the 126 days open the sampling days were 64, for the summer 2003 of the 91 days that the library was open, the sampling days were 21; and for the

spring 2003 of the 119 days the library was open, the sampling days were 52. On the days identified as sample days, data was collected during all open hours. The numbers were then extrapolated for each month.

Table 4 shows the number of actual reference questions tallied by months for the years 2001-2002, and for 2002-2003, and 2003-2004 as extrapolated for each month by the sampling method, and the annual totals.

Table 4
Monthly count of Reference Questions for Actual 2001-2002
and Sampled Count 2002-2003 and 2003-2004

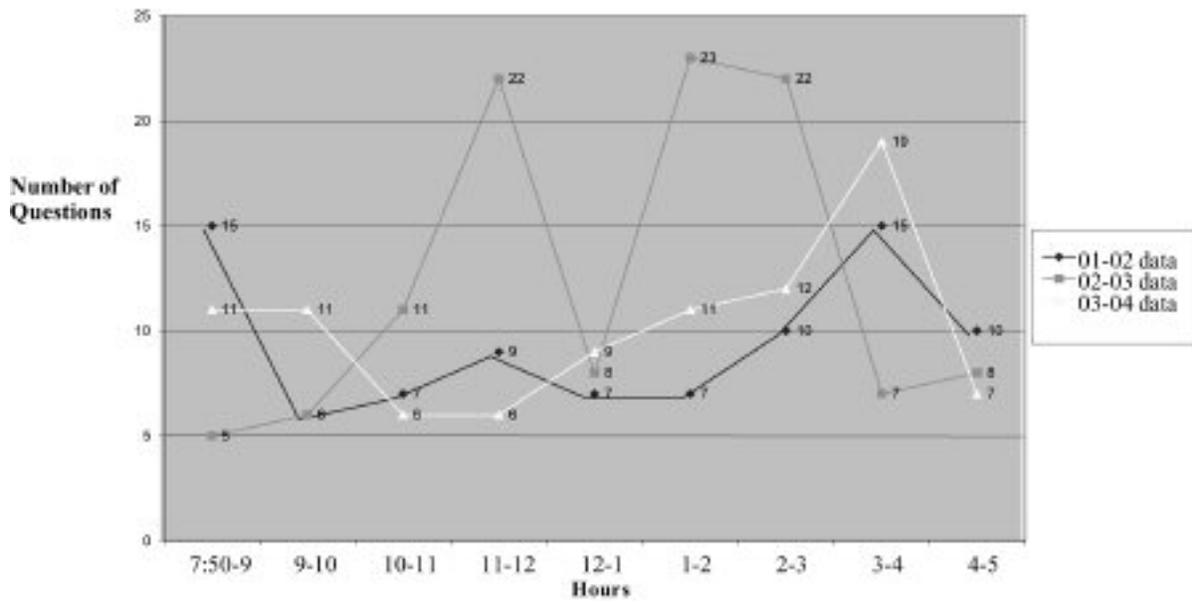
Months	ACTUAL COUNT	SAMPLE COUNT	SAMPLE COUNT
	2001/2002	2002/2003	2003-4
July	616	608	682
Aug	1100	917	1622
Sep	1781	2164	2502
Oct	1805	1633	1893
Nov	1501	1782	1725
Dec	404	345	763
Jan	1352	1666	1444
Feb	1364	1358	1351
Mar	1419	1620	1444
Apr	1464	1355	1096
May	728	516	632
June	645	621	600
Total	14179	14585	15754

(The numbers include all categories of questions e.g email questions, which were not included in analysis)

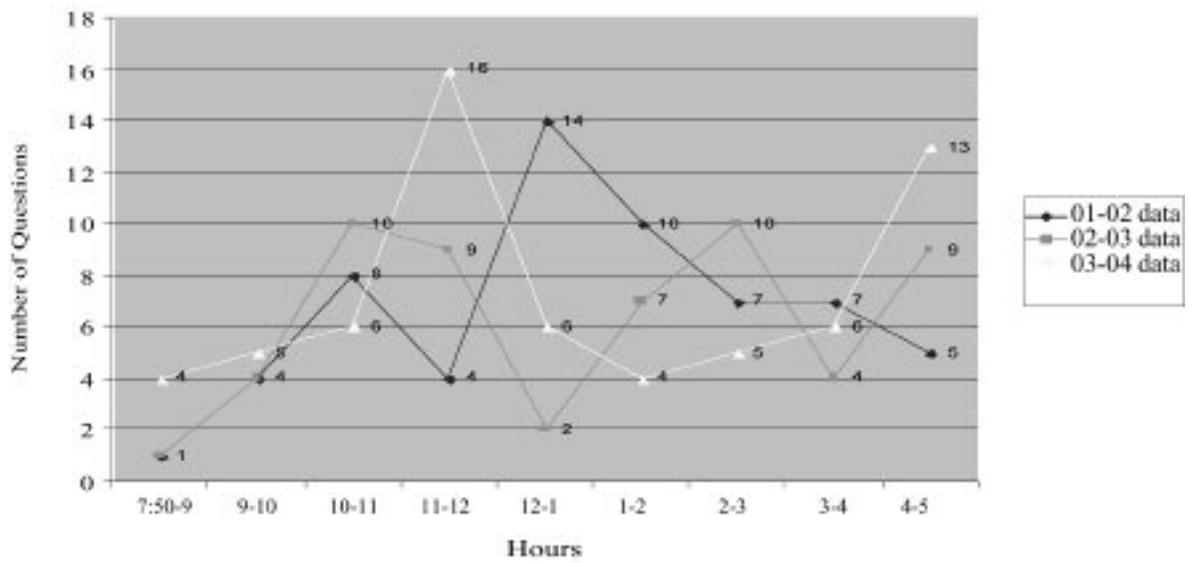
The number of total reference questions answered during the year 2002-2003 and 2003-2004 (sampling years) were higher than 2001-2002 (daily count) by 2.8% for 2002-2003 and by 11% in 2003-2004. But when analyzed using the standard error of two different means at 95% confidence level (standard error of means = $\frac{s}{\sqrt{n}}$) the difference between the actual and the sample means and their standard error for the years 2001-2002 and 2003-2004 was within the acceptable range of 1.7. Since the numbers for 2002-2003 were even lower than 2003-2004 it was concluded that the sample statistics can serve the accountability requirement.

An attempt was also made to determine if the data collected by the random sampling method for the years 2002-2003 and 2003-2004 shows similar trends as 2001-2002. The number of questions for the day of the week for sample days during 2002-2003 and 2003-2004 were compared with the same day of the week with the year 2001-2002. For example all Mondays for which the data was collected in 2001-2002 were compared with the Monday of the same week in 2003-2004 and 2002-2003 (if sampled). The following graphs show similar trends in the number of questions handled at the reference desk.

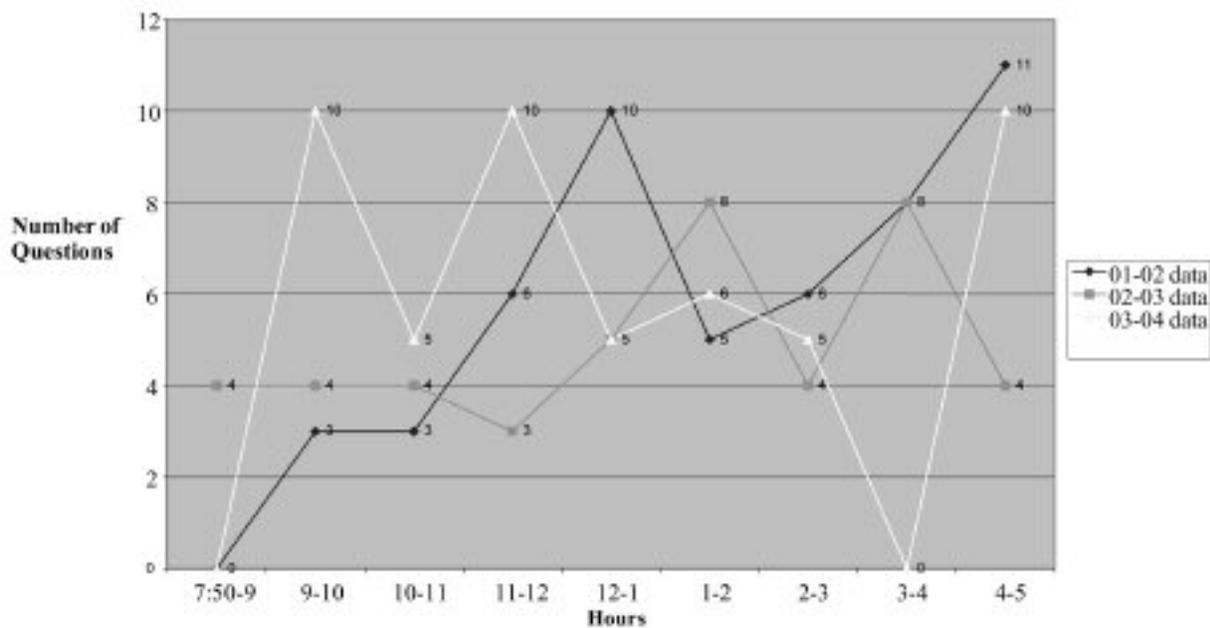
1st Week of September-Tuesday



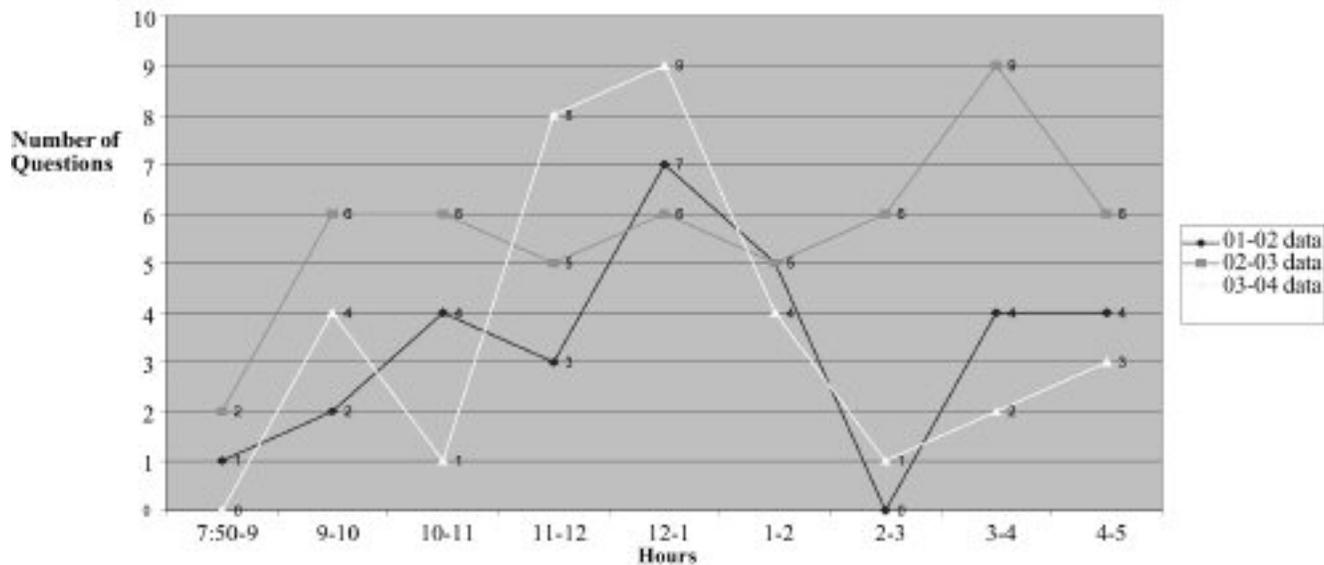
2nd week of November - Monday



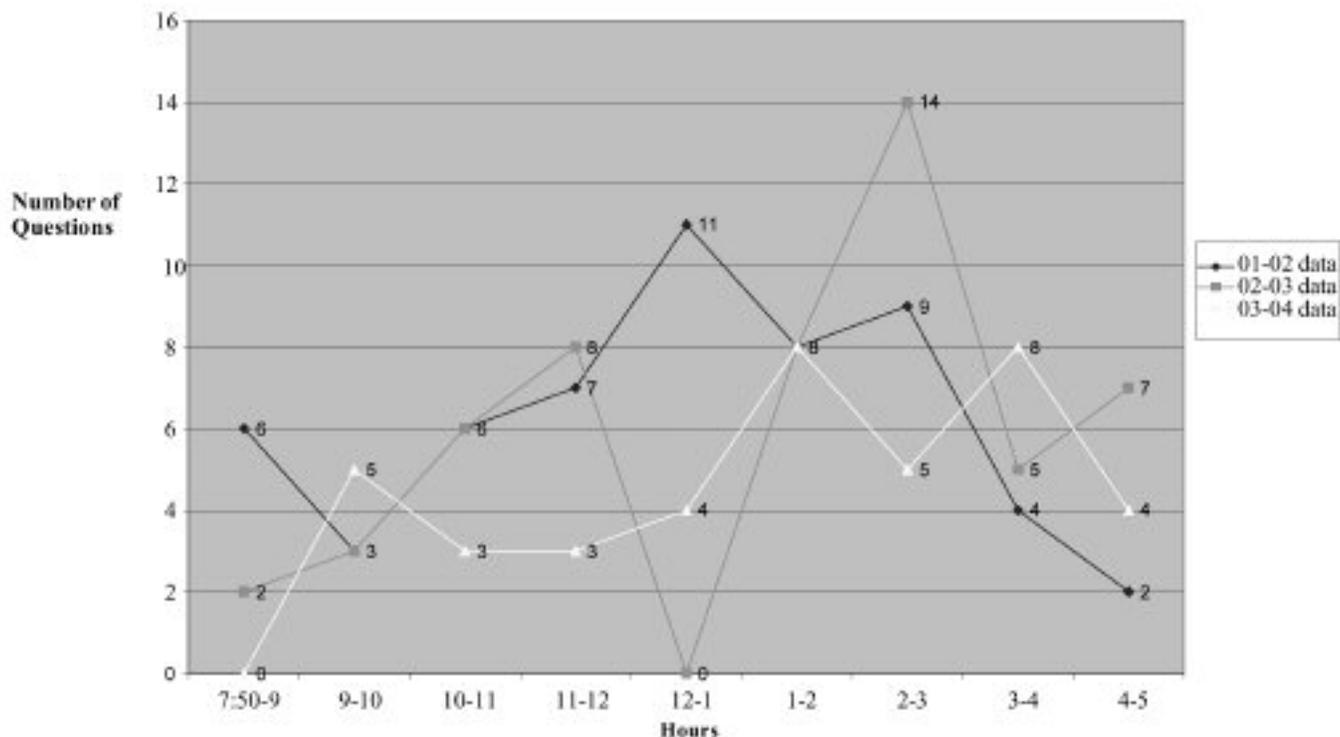
2nd Week of April-Tuesday



2nd Week of February-Thursday



2nd Week of October-Tuesday



Conclusion

The results of statistical analysis show that the numbers gathered by the sampling method are very close to the numbers gathered by actual count between the two years of data under consideration. As a result the department decided to continue gathering reference statistics with the sampling method. Sampling its own advantages and disadvantages

Advantages are that statistics are gathered during a fewer number of days and so a more conscientious effort is made by all to keep accurate statistics. Reference librarians record the transactions

in a standard accountable manner, within an acceptable error and confidence level.

Disadvantages are that sampling must be justified to the administration as a reliable method of providing accurate statistics for internal and external use. Sampling also involves some administrative planning, e.g. calculation of random days on which the statistics will be gathered, distribution of forms, effort on the part of the reference staff to remember to keep statistics, and a commitment from the members of reference faculty to keep accurate statistics.

Limitations of the study

This study measures only one of the reference activities, namely questions asked at the reference desk. Other aspects of reference transactions not studied are:

- Type of questions asked under each category.
- Type or classification of the patron served.
- Type of resources used to answer questions.
- Databases, e-journals or web sites and other electronic resources accessed by the patrons (in the library or from remote sites) and how efficiently and effectively.
- Reference service delivered outside of reference desk.

To get a complete picture of reference interactions new measures are required to capture the complexity of reference service. New technologies enable librarians to do more and provide more information to the users. As indicated by the literature review, many libraries are already attempting to analyze the reference statistics by the type of questions, resources used, and by the promptness of response. Some libraries are attempting to gather remote database use statistics as well. Librarians are also trying to establish a uniform reporting system of use across vendors (e.g. ICOLC, NISO, ARL, and ACRL). The UTC library needs to do the same. These data compilation measures do not assess the quality of library services in meeting user needs. New measures and initiatives are needed that assess the library's impact on teaching, learning, and research as well as on the ability of the library to control costs and add value to the serv-

ice they provide. Sample statistics gathered for all types of services provided by the reference librarians will provide the data for measuring the demand and for planning and providing efficient reference service. Complexity and value of reference service will be realized when all aspects of reference service have been measured, accounted for, and analyzed.

Reference service is essentially a human science. It is based on personal relationship between the librarians and the patrons (Richardson, 2002, 42). Automation has lent some efficiency and ease to the process, however it has not reduced the need for human help. However, we are living in an age of accountability and so managerial effectiveness of the operation must be measured in order to optimize the services. It is important to understand and document how demand, workload, and accessibility are related, in any particular library. Even though there is no perfect way to determine how busy reference is going to be at any given moment, statistics can give us an idea of which times are busier than others. These data can help in predicting the future demand (Taylor, 1994).

This was an attempt to see if random sampling could take the place of every day counting of the transaction counts, at the reference desk. This study showed that the statistical sampling method does work. The time spent on data collection was reduced, and at the same time the accountability needs of the higher administration have been satisfied. Statistical measures have provided a standardized scientific method for identifying the high, medium and low usage of reference service during the academic year. Random sampling has enabled the UTC librarians to identify a pattern of demand which will in turn help in assessing and planning future service.

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