



Public library patrons' use of collaborative chat reference service: The effectiveness of question answering by question type

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Abstract

This study investigated the effectiveness of question answering by question types in the inter-institutional collaborative chat reference service at a public library system. In particular, this study examined whether subject-based research type questions are answered as effectively as simple factual type questions, and whether local-specific questions are answered as effectively as non-local questions in the inter-institutional chat reference service. Effectiveness was assessed in terms of answer completeness and user satisfaction. The analysis was based on user surveys and corresponding transcripts of 415 chat reference transactions initiated by patrons of a public library system. The study found little difference in the effectiveness of question answering between subject-based research and simple factual questions. However, local-specific questions, such as circulation-related and inquires about local library services, were answered less completely and patrons expressed lower levels of satisfaction compared to non-local questions. These findings indicate problems and gaps in coordinating the inter-institutional chat reference service among participating libraries. Implications to design seamless services in the collaborative service were discussed.

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1. Background

Over the past several years, inter-institutional chat reference collaboration has brought libraries a new opportunity for reference services in the digital library environment. As one of many virtual reference service modes, this service enables online real-time interactions between the user and the librarian on regional or national levels. By networking on a synchronous chat reference application that includes such functions as instant messaging and co-browsing, participating libraries in a consortium share their staff and resources to deliver reference services through inter-library collaborations. This new service enables library patrons to get benefits from subject experts and richer resources in other participating libraries (Kasowitz, Bennett & Lankes, 2000; Tenopir, 2004). Some of these services offer 24 hours a day and 7 days a week access so patrons are able to obtain services from other libraries even when their branch libraries are closed. From the library managerial perspective, inter-institutional chat service has been suggested to enhance cost-effectiveness of the costly stand-alone chat reference services (Bailey-Hainer, 2005; Coffman & Arret, 2004a, 2004b; Tenopir, 2004).

Because of many benefits, various types of libraries have a high interest in collaborations for an effective reference service. As evidence of its popularity, approximately 1,730 libraries were estimated to be participating in a total of 62 collaborative services as of November 2003 (Coffman & Arret, 2004a). This number has further increased up to approximately 76 collaborative services as of October 2004, indicating its continuing growth (Sloan, 2004). Among different types of libraries, public libraries have shown great interest in collaborative chat reference. According to Sloan's (2004) comprehensive list, 20 of the 76 collaborative synchronous reference services consisted solely of public libraries. An additional 21 services consisted of mixed types of libraries, including public libraries.

2. Problem statement

Despite the increasing popularity and public libraries' active participation through regional or national consortia (Nilsen, 2004; Sloan, 2004), little is known about what questions public library patrons bring to inter-institutional collaborative chat reference services and how effectively those questions are answered by the consortia. When reference services are available in different modes of communication technologies, from traditional face-to-face interactions, text-based real-time chat reference, to Voice Over Internet Protocol (VoIP) technology, an optimal coordination of variant modes becomes important in delivering the service. Because each different mode has different strengths and weaknesses, the service providers should understand which reference modes work best for which types of questions.

Accordingly, it is a question of whether chat reference service is effective in answering any type of questions or certain types only. For example, is chat reference communicated over instant text messaging an effective channel for subject-based research questions? Because subject-based research questions typically involve librarians' effective verbal and non-verbal communication skills in order to figure out real information needs of the patrons, the text-based chat reference might be somewhat limited in providing answers. However, because the

service is delivered via inter-institutional collaborations, it is also possible that subject-based research questions can be answered more successfully by making effective referrals to subject experts in other member libraries.

Another concern that relates to inter-institutional reference service is how effectively librarians from other library systems answer questions that may require either access to a patron's local library databases or specific information about the library or community. How seamlessly do "outside" librarians assist the patrons who ask "local" questions but have little familiarity with the service mechanism of the inter-institutional consortia? Most patrons would not necessarily be interested in who answers their questions but in getting a prompt answer.

While there is an extensive body of literature examining the effectiveness of question answering, few have investigated the phenomenon empirically with respect to question types for the inter-institutional chat reference service. In fact, as Pomerantz (2006) stated, interlibrary reference service is a largely new concept compared to other areas of library work, and as is the research in this area. Therefore, the purpose of this study was to investigate the effectiveness of question answering in the inter-institutional chat reference collaboration service at a public library setting. This investigation of question-answering effectiveness across different types of questions would help to identify the question types conducive to inter-institutional chat reference service and to develop effective question routing systems for the service.

3. Literature review

3.1. *Question types*

Understanding the question is an essential first step to effective question answering (Pomerantz, 2005; Whitlatch, 1995). For this reason, there has been a great effort to identify the typology of questions posed to the reference desk. Pomerantz (2005) has attempted to identify useful question taxonomies through his extensive review of three areas in the literature: linguistics, the Text Retrieval Conference (TREC) Question Answering (QA) track research, and traditional and digital reference services. This comprehensive survey of question typologies provides a conceptual foundation to develop automatic question answering systems in the digital reference service.

On a more empirical level, studies that examined chat reference interactions report that patrons bring to the service a gamut of simple to complex questions (Arnold & Kaske, 2005; Braxton & Brunsdale, 2004; Diamond & Pease, 2001; Kibbee, Ward, & Ma, 2002; Lee, 2004). These questions, which do not seem to be drastically different from those asked at a physical reference desk (Brown, 1985; Bunge, 1990; Katz, 2002, Rothstein, 1964), range from simple factual questions, complex research inquiries, requests for renewals, course reserves, interlibrary loans, technical problems in accessing remote library databases, to questions about the library and its services. According to Arnold and Kaske (2005) who analyzed 419 chat reference transactions conducted in an academic library, a large proportion of questions relate to library policies or procedural information (41%), followed by subject search (23%), holding or known-item search (16%), ready reference (14%), and directional questions (6%).

These studies mostly inform the types of questions posed to a stand-alone chat reference at individual academic libraries.

3.2. Effectiveness of question answering by question type

A successful question answering is affected by the nature of the question asked. Regarding inter-institutional chat reference in particular, its nature of virtual collaborations among multiple libraries may be conducive to answering certain types of questions better than others. In this regard, the effectiveness of question answering can be compared for the following two pairs of question types: (a) simple factual versus subject-based research questions, and (b) local versus non-local generic questions.

3.2.1. Simple factual versus subject-based research questions

Questions at the reference desk are often divided into two broad categories: directional and reference questions. The directional question relates to helping patrons with finding and using library resources and services with relatively lower levels of staff expertise and efforts, whereas the reference question entails higher level of staff expertise in assisting the patrons with identifying and utilizing information sources (White, 1981). When it comes to chat reference, a general perception is that chat reference is suitable mostly for the directional but not the reference questions (Janes, 2002; Lee, 2004; Straw, 2000). In other words, chat reference is more effective in answering short, factual questions but is ineffective for more sophisticated subject-based research questions. This perception is partly because chat reference, compared to traditional physical reference, lacks audio-visual cues (e.g., body posture, attentiveness, smiling, frowning, and tones of voice) that can facilitate reference interviews. Supporting this contention, Kibbee et al. (2002) reported that simple factual and directional questions tended to be answered more promptly and clearly in chat reference than their counterparts. Nilsen (2004) also supports this finding by reporting that reference interviews, which are generally conducted for subject-based research questions, appeared only approximately 20% of total chat reference transactions as opposed to approximately 50% in physical reference transactions.

Nonetheless, some researchers believe that chat reference should be able to answer beyond basic ready reference questions (Diamond & Pease, 2001; Gray, 2000). The standards for collaborative virtual reference, developed by Kasowitz et al. (2000), include reference interview and instructive functions of the service, which certainly go beyond simple factual questions. More importantly, the behavioral guidelines of the Reference and User Services Association (RUSA, 2004) of the American Library Association, which was revised in 2004 to serve as training and assessment tools for both physical and virtual reference services, hold the same position by stating that real-time reference interviews should be able to handle complex subject search questions. Among the handful of reports that support this view, Ward (2004) stated that 78% of chat reference transactions at an academic library showed some indication of bibliographic instruction or question negotiations, which occurs typically in subject-based research questions. Most of all, the very fact that inter-institutional chat reference is aimed at sharing subject expertise and resources among participating libraries maintains a high expectation of answering subject-based research questions.

3.2.2. *Local versus non-local questions*

In the traditional reference desk setting, it has been a concern how effectively referrals could be made to outside services or experts for the unanswered questions by local librarians (Dewdney & Ross, 1994). Interestingly, a quite reverse concern seems to be raised in the inter-institutional service setting where a high proportion of questions are received by *outside* librarians in the consortium rather than by the patron's local librarians. According to Pomerantz (2006), among the users who logged into the chat reference of a library system, 84% of the users were greeted by the outside librarians in the consortium. Therefore, a pressing question about inter-institutional collaborative reference would be how effectively outside librarians answer questions that require either access to a patron's local library databases or specific information about the patron's local library or community (Kibbee et al., 2002). By not obtaining instant answers from outside librarians, library patrons whose questions are referred back to their local libraries would be either confused or frustrated due to their wasted time and effort in obtaining the answer (Kern, 2004). Because the patrons are not necessarily aware of nor understand the boundaries between libraries in a consortium and the procedures and service policies established by a consortium, they would be left to ponder, "What kind of questions am I supposed to ask to this service?" Thus, the effectiveness of an inter-institutional chat reference service could be directly influenced by the service's capability to manage the local questions properly.

3.2.3. *Measures of question-answering effectiveness by question type*

Over the past decades, many outcome measures have been developed to assess the effectiveness of question answering of traditional reference service (Saxton & Richardson, 2002). Herson and McClure (1986) adopted answer accuracy as a measure of service effectiveness, which became the well-known "55% Rule" in the reference literature referring to the phenomena that librarians answered reference questions correctly only 55% of the time. Others employed measures such as answer completeness and user satisfaction. Durrance (1989) yet proposed another alternative measure, the user's willingness to return to the same librarian to ask another question. Because of the variability of the effectiveness measures, Saxton and Richardson (2002), in their meta-analysis study of reference effectiveness, attempted to compare the explanatory power of the four most frequently used outcome measures found in the literature. The four measures include completeness, usefulness, satisfaction, and accuracy.

While these measures were developed in traditional reference, some of them have been adopted in the virtual reference setting. Answer completeness, one of those measures, relates to how completely questions are answered during a reference transaction. According to Kibbee et al. (2002), answer completeness, measured by the patrons' perception, was very good or excellent for approximately 90% of 130 respondents. Similarly, Ward (2004) reported that the general answer completion rate of chat reference is as high as 70%. Other than this overall completion rate, the extent of answer completion of each different question type is yet to be known.

User satisfaction, another outcome measure, is one of the most frequently used measures in reference effectiveness literature (Saxton & Richardson, 2002). User satisfaction relates to the degree to which users are satisfied with the service obtained. Despite its weaknesses in that most users express high satisfaction, Saxton and Richardson (2002) found that user

satisfaction is influenced by librarians' reference interview behaviors, indicating its capability to measure reference effectiveness.

The level of user satisfaction among chat reference users has been reported to be high in general. Robins and Miller (2003) reported that 89.9% of users were satisfied with the stand-alone chat reference service of a university library system. A similar result was found among the patrons of a North Carolina public library system that participated in a nationwide chat-based reference consortium (Pomerantz & McClure, 2004). Patrons expressed high levels of satisfaction across all indicators: answer completeness (67% very satisfied), the speed of answering the question (63% very quickly), and the helpfulness of the librarian (77% very helpful). As such, chat reference users have reported high satisfaction with the service in general presumably because they perceive the service as being prompt, convenient, innovative, and useful (Kwon & Gregory, *in press*).

Although the question answering capability of chat reference is largely positive, both the answer completion rate and the level of user satisfaction may vary across different question types. First, it is conceivable that subject-based research questions are less completely answered than simple factual questions because the former typically involve complex tasks such as question negotiations by using text-based communication mode. Thus, the level of user satisfaction with subject-based research questions would not be as high as that of simple factual questions. However, it is also possible that subject-based research questions have a higher chance of being completed, if unanswered questions are routed effectively to the subject experts in other participating libraries. This would enhance the level of user satisfaction ultimately.

Furthermore, when it comes to the localness of questions, it is probable that questions specific to their *local* libraries would be less likely to be completed than *non-local generic* questions because answering local specific questions may involve either specific information about the local library or an access to the library's proprietary databases. Thus, the level of user satisfaction could be low if questions are answered by the outside librarians who have either limited knowledge of the users' local libraries or restrictions in using the proprietary databases.

4. Research questions

Based on the review of literature on collaborative chat reference, three research questions were proposed for investigation:

1. What is the profile of questions that public library patrons bring to inter-institutional collaborative chat reference?
2. In the inter-institutional collaborative chat reference, is the effectiveness of question answering different among different types of questions? Specifically,
 - a. Is there any difference in the level of answer completeness between simple factual questions and subject-based research questions?
 - b. Is there any difference in the level of user satisfaction between simple factual questions and subject-based research questions?
 - c. Is there any difference in the level of answer completion between local questions and non-local questions?

- d. Is there any difference in the level of user satisfaction between local questions and non-local questions?

5. Procedures

A large public library system comprised of 33 regional and branch libraries in the state of Florida was examined for the present study. That system has offered a chat-based collaborative reference service since August 2002 by joining the Metropolitan Cooperative Library System (MCLS), a nationwide virtual reference consortium of public, academic, and corporate libraries. The system provided the service for 24 hours a day, 7 days a week using the 24/7 Reference software. This software is equipped with a wide range of functionalities, including text-based instant messaging, pre-scripted messages, co-browsing and document pushing, archives of transaction transcripts, and managerial statistical reports. Although anybody with Internet access could log in to the service via the library system investigated, the majority of the patrons consisted of the general public affiliated with the library system. The patrons' questions were answered by the librarians and subject specialists from 49 participating library systems across the United States.

The data analyzed for the current study were reference transactions that were initiated by the patrons of the library system between January and June 2004. This particular time frame was selected for two reasons. First, as the most recent time from the initiation of the present study, it has passed its pilot stage that typically accompanies frequent system errors. This passage of time helped to minimize some possible unfamiliarity and initial confusions about the new service experienced by both patrons and librarians. Thus, it enabled the researcher to observe a stable usage pattern. In addition, the 6-month period observation was long enough to provide a sufficient number of transactions that allowed the researcher to examine most usage patterns.

A total of 1,387 transactions occurred during this 6-month period. The system incorporated a user evaluation component where a seven-item online survey popped up upon the completion of each transaction. Patrons took this exit survey on a voluntary basis. A total of 420 among the 1,387 transactions had a matching user survey response, which comprised 30.1% of the total transactions. After removing five incomprehensible questions, a total of 415 transactions were included in the final data analysis.

6. Measurement

6.1. Question type

Question types were measured via content analysis of transaction transcripts.¹ In this section, the two pairs of question types stated in the research questions are defined for the current study.

¹ A detailed coding process is presented in Section 7.

6.1.1. *Simple factual versus subject-based research questions*

- *Simple factual question* refers to known-item search questions, directional questions, or a question of a factual nature that can be answered quickly by consulting only one or two reference tools (Garnsey & Powell, 2000). Examples include “Is the book ‘Funny Laws and Other Zany Stuff’ by Sheryl Lindsell-Roberts available?,” “What does ‘borrower status: restricted’ mean?,” and “What is the correct way to write this name, in last name first order: Dr. James R. J. Smith, III?”
- *Subject-based research question* refers to a reference question requesting a particular kind and number of books or journal/magazine articles on a specific topic, teaching the steps of the research process, locating hard to find literature, and guidance with database choices (Marsteller & Mizzy, 2003; Ward, 2004). Examples are, “Can you tell me how to celebrate children’s day in America?,” “I want to know the titles of 5 books that deal with the development of gender identity,” and “Where can I find a current article on the culture of any indigenous tribe?”

6.1.2. *Local versus non-local questions*

- *Local question*, for the purposes of this study, refers to questions that involve both circulation and information about a local library, and the answer may or may not be readily found from the library Web site. Questions that fall in this category include: “Can you check which books are overdue in my record?,” “Can I use a typewriter in Sunrise branch library?,” “I am looking for a job at this library,” and “I saw I have a 60 dollar fine. Is there a payment plan or forgiveness policy I could do to be able to check out books again?”
- *Non-local question*, for the purposes of this investigation, refers to a generic question that does not involve a locally restricted database use or local knowledge to answer the question. It includes both simple factual questions and complex subject-based research questions that can be answered using general reference tools or other resources.

6.2. *Answer completeness*

Answer completeness refers to the level of completeness that library staff provides solutions to the patron’s inquiry during the reference transaction. Answer completeness was measured via content analysis of the transaction transcripts. Answer completeness of each transaction was coded into one of the following four categories: completed; referred; partially answered or unanswered; and problematic ending. Each category was defined as follows:

- A transaction was coded as “completed answer” if a transcript indicated that the librarian offered the patron direct answers or sources that may include answers to the patron’s question and that the librarian ends the transaction with a proper closure. Additional sources of information may be provided to the patron along with the answer to the initial

question. A proper closure was determined by the following four specific behavioral items prescribed in the RUSA's Guidelines for Behavioral Performance of Reference and Information Services Providers" (RUSA, 2004). A transaction was coded to be properly closed if librarians utilized one of the following RUSA guideline statements during reference transactions:

- asks the patrons if additional information is needed after an initial result is found (e.g., "Is there anything else I can help you with?");
 - asks the patrons if their questions have been completely answered (e.g., "Did you find what you needed?," "Does this completely answer your question?");
 - encourages the patrons to return if they have further questions (e.g., "If you don't find what you are looking for, please come back and we'll try something else."); and
 - takes care not to end the reference interview prematurely.
- A transaction was coded as "referred" when a transaction indicated that the patron's initial question was not answered during the reference transaction but offered referrals to other information sources or agencies that may or may not answer the question.
 - A transaction was coded as "problematic ending" when a transaction was ended before the patron received the answer. This happens because of disconnections, delayed answers, or uncertain reasons. It also includes librarians' premature ending without proper closing remarks and system failure due to connection problems.

Fig. 1 shows the results of answer completeness based on total transactions ($N=415$): completely answered transaction was 56.4%, either transferred or referred back to local libraries or other sources was 29.0%, either partially answered or unanswered without offering referrals was 4.8%, and problematic ending was 9.8%.

6.3. User satisfaction

User satisfaction was measured by patrons' responses to the following three questions in the online pop-up survey administered immediately after each reference transaction:

- Satisfaction with the answer: "Were you satisfied with the answer you received to your reference question?" (Note: Respondents chose one from "yes," "not sure," and "no");
- Perceived staff quality: "The quality of the library staff service in answering this request was ____." (Note: Respondents chose one from the categories of "excellent," "good," "average," and "poor"); and
- Willingness to return: "Will you use this service again?" (Note: Respondents chose from "very likely," "maybe," and "never").

These question items were combined to create a composite variable of satisfaction. Measurement research literature indicates that a composite variable yields a score that is generally more valid and reliable than does a single item (DeVellis, 1991). The mean of the overall user satisfaction was 12.69 with a standard deviation of 3.44 in the range between a minimum value of 3 for "highly dissatisfied" and the maximum value of 15 for "highly

satisfied.”² Despite intrinsic weaknesses of user satisfaction, the operationalization of user satisfaction in the present study is considered to be robust because it not only incorporated Durrance’s (1989) “willingness to return” but also is supported by results of the validity and reliability tests described in the following section.

6.4. Validity

A factor analysis was conducted to determine the validity of the composite variable of user satisfaction measured by three questionnaire items. The analysis revealed that the three items were loaded on one-factor solution, with structure–pattern coefficients of 0.868, 0.916, and 0.876, explaining 78.64% of the total variance in the factor. These high scores indicate that the three questionnaire items measure a single construct, suggesting that the composite variable is a valid measure of user satisfaction (Bollen, 1989).

6.5. Reliability

The reliability of the composite variable of user satisfaction was tested by a classical theory alpha reliability coefficient. As a result, a Cronbach’s alpha coefficient, an index measuring how

² Many widely used psychological variables (e.g., satisfaction, anxiety, motivations, and self-efficacy) are measured as a composite variable of multiple questionnaire items measured on an ordinal-level scale. These variables are considered to be interval level because the constructs are continuous in their nature. This logic provides a rationale of the use of a composite variable for user satisfaction. Moreover, because these ordinal level measures are not suitable to undertake inferential statistical tests, the conversion to an interval variable allowed the researcher to conduct inferential statistical tests that are necessary to answer research questions of the present study. Thus, a series of computations were conducted to create a composite variable of user satisfaction using the three questionnaire items that were measured on a three-point or four-point ordinal scale (e.g., “satisfied,” “not sure,” and “not satisfied” for “satisfaction with the answer” item). First, the ordinal level data variables were recoded on a 5-point scale as shown below:

	Negative				Positive
	1	2	3	4	5
1. Satisfaction with the answer	Unsatisfied	Not sure			Satisfied
2. Perceived staff quality	Poor		Average	Good	Excellent
3. Willingness to use the service again	Never		Maybe		Very likely

As shown on the above diagram, for *satisfaction with the answer* item, 1 was assigned for “unsatisfied,” 2 for “not sure,” and 5 for “satisfied.” For *perceived staff quality* item, 1 was assigned for “poor,” 3 for “average,” 4 for “good,” and 5 for “excellent.” For *willingness to return* item, 1 was assigned for “never,” 3 for “maybe,” and 5 for “very likely.” After the three items were rescaled on the same 5-point scale, they were summed up as a single composite variable, with the minimum value being 3 and the maximum value being 15. To minimize the arbitrariness in assigning numeric values to these verbal descriptions, this procedure was repeated for two other scales (i.e., 4-point and 6-point scales) by making slight variations in value assignment. In order to validate the stability of the assigned values, a series of the same statistical analyses that examined the research questions were undertaken on all three scales. All three scales produced the identical test results, supporting the use of the five-point scale.

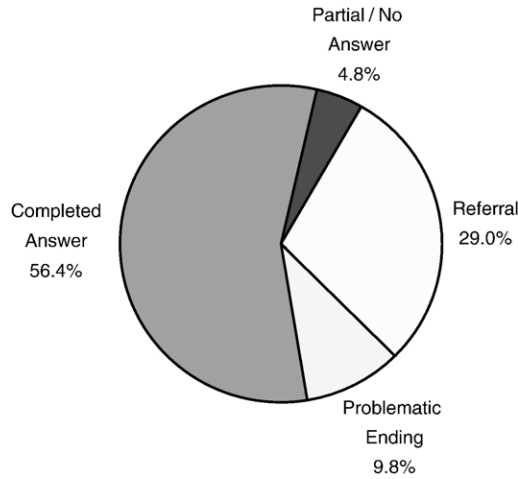


Fig. 1. Answer completeness of collaborative chat reference ($N=415$).

well the individual measures intercorrelate, was obtained as 0.85, indicating the composite variable is a reliable measure with respect to the customary threshold low-end cut-off value of 0.70 (Kline, 1999).

Inter-coder reliability tests were undertaken to ensure the consistency of coding for both question type and answer completeness. The tests inform the level of agreement between two independent coders. To obtain the reliability scores, the researcher coded the entire 415 transactions in the first step. Then, the second coder, a reference librarian who received training for coding the RUSA behaviors, coded every fifth transaction of the 415 transactions ($n=83$). This number comprised 20% of the total transactions, which is a recommended percentage for social science research (Neuendorf, 2002). A widely used Cohen's Kappa (k) was used as the inter-coder reliability index for this study and was calculated using SPSS 13.0 (SPSS Inc., 2004). Kappa coefficient was found to be 1.00 for question type and 0.75 for answer completeness, indicating high agreements between the two coders in coding both variables (Neuendorf, 2002).

7. Results

7.1. Question profile

Among various approaches, the current study took the approach of classifying the questions by the forms of the expected answer to a question (Pomerantz, 2005). Accordingly, a profile of questions was emerged into 14 types of questions from content analysis of transaction scripts (Table 1). Because a fewer number of categories is conducive to bivariate data analysis that is needed to answer the research questions, the initial 14 types were then collapsed into five broad question types: simple, factual questions; subject-based research questions; resource

Table 1
Question types in inter-institutional collaborative chat reference (N=415)^a

Initial 14 question types	Frequency	Percent	Final 5 question types	Frequency	Percent
Known-item search (e.g., do you have ...?)	34	8.1	Simple factual questions	40	9.6
Ready reference	6	1.4			
Subject search/reference question	107	25.8	Subject-based research questions	107	25.8
NetLibrary account creation	20	4.8	Resource access questions	37	8.9
Resource use (Catalog, DB, resource: interpretation of terms)	13	3.1			
Technology use (e.g., e-mail account setup)	4	1.0	Circulation-related questions	203	48.9
Online renewal (e.g., How do I renew CDs online?)	53	12.7			
Online hold (e.g., Can I reserve a book online, Circulation-related query (e.g., Can I change the library for pickup?, Policy, ILL)	37	8.9			
Account access (e.g., I don't know how to access the account; update account info; fine info check)	42	10.0			
Account problem (e.g., incorrect circulation records, doesn't allow me to access the account online)	21	5.0			
Local library programs/event information	6	1.4	Local library information inquires	28	6.8
Local library's available services, facilities	15	3.6			
Staff contact (e.g., filing complaints)	7	1.7			
Total	415	100.0		415	100.0

^a A total of 415 transactions were examined after removing five ambiguous questions.

access questions; circulation-related questions; and local library information inquiries (Table 1, Fig. 2). In addition to the first two types defined in the earlier section, the rest three question types are characterized as follows:

- Resource access question refers to an inquiry about access and use of library catalogs, databases, or other library resources;
- Circulation-related question refers to an inquiry about circulation policies or patrons' personal account; and
- Local library information inquiry refers to a question that involves information about a local library.

Fig. 2 depicts the profile of the questions asked to the collaborative chat reference by public library patrons. Circulation-related questions were most frequently asked, comprising 48.9% of 415 questions. The second frequently asked questions were subject-based research questions (25.8%), followed by simple factual questions (9.6%), resource access questions (8.9%), and local library-related information inquiries (6.8%).

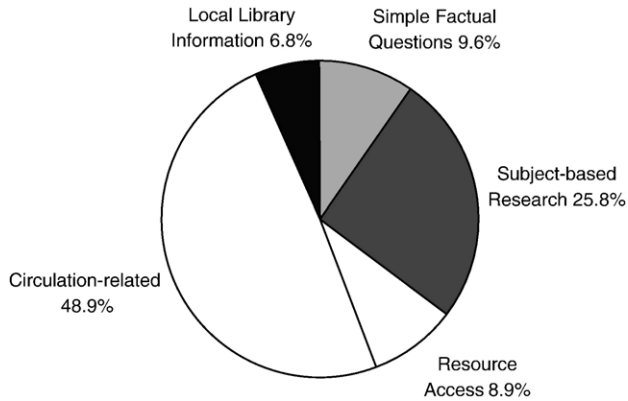


Fig. 2. Occurrence of five question types ($N=415$).

7.2. Answer completeness across five question types

The level of answer completeness was measured in four levels: completely answered, partially answered or unanswered, referred, and problematic endings. Fig. 3 shows these four different degrees of answer completeness within each of the five question types.

When comparing the completely answered transactions across the five types of questions (Fig. 3), the simple, factual question category shows the highest answer completion rate (77.5%), followed by subject-based research (70.1%), resource access (56.8%), local library information (53.6%), and circulation-related questions (45.8%). A chi-square test was employed to determine if the degrees of answer completeness vary across the five question types. The test results revealed statistically significant differences in answer completeness at an alpha level of 0.05 ($\chi^2(12, N=415)=71.616, p<0.001$). The effect size associated with this relationship, as measured by Cramer's V , was 0.24, which suggests a small to medium effect size (Kline, 2004). This result shows different degrees of answer completion across different types of questions in collaborative chat reference.

7.3. User satisfaction across five question types

Fig. 4 shows the average user satisfaction by each of the five question types. User satisfaction was the highest in subject-based research questions among all five question types (mean=13.31, $SD=3.05, n=107$). Simple factual questions (mean=13.02, $SD=3.39, n=40$) were the second highest, followed by local library information inquiries (mean=12.75, $SD=3.41, n=28$), circulation-related questions (mean=12.43, $SD=3.57, n=203$) and resource access questions (mean=12.32, $SD=3.42, n=37$). An analysis of variance (ANOVA) was conducted to determine the difference in user satisfaction among the five question types. User satisfaction across the five question types was not statistically significantly different at an alpha level of 0.05, $F(4, 410)=1.37, p=.243$.

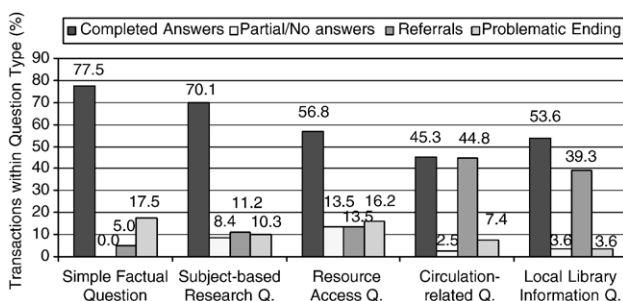


Fig. 3. Answer completeness by question type ($N=415$).

7.4. Simple factual versus subject-based research questions

Simple factual questions and subject-based research questions were compared for their differences in answer completion rates (RQ2-a). The chi-square test of independence revealed that the difference in answer completeness between the two question types was not statistically significant at an alpha level of 0.05 ($\chi^2(3, N=147)=6.006, p=0.111$).

The two question types were also compared for their differences in the level of user satisfaction (RQ2-b). Fig. 4 indicates a somewhat higher level of user satisfaction among subject-based research questions (mean=13.31, $SD=3.05$) than simple factual questions (mean=13.02, $SD=3.39$). Nonetheless, this difference was not statistically significant at an alpha level of 0.05, $t(145)=-0.496, p=0.621$.

7.5. Local versus non-local questions³

Local questions and non-local questions were compared for their differences in answer completion rates (RQ2-c). As Table 2 shows, the local questions (46.3%) were answered less completely than the non-local questions (72.1%). The difference was found to be statistically significantly different at an alpha level of 0.05 ($\chi^2(3, N=378)=51.350, p<0.001$). The effect size associated with the differences, as measured by Cramer's V , was 0.369, which suggests a medium effect size. This finding indicates that, in an inter-institutional collaborative chat reference, local questions were statistically significantly less completely answered than non-local, generic questions. These results are discussed in detail in the discussion section.

Local and non-local questions were also compared for their differences in user satisfaction (RQ2-d). User satisfaction of local questions (mean=12.47; $SD=3.55$) was lower than that of

³ In determining local versus non-local questions, both circulation-related and local library information questions were categorized as local questions ($n=231$) because answering these questions generally involves either the use of locally restricted resources or local knowledge. In contrast, both simple factual questions and subject search questions were categorized as non-local questions ($n=147$) because those questions could be answered by "outside" librarians by using reference or general information resources. Resource use questions were not categorized for this analysis because local knowledge may or may not be involved in answering those questions.

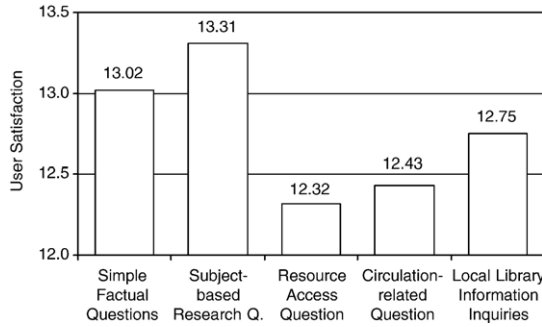


Fig. 4. User satisfaction by question type (mean=12.7, SD=3.4, N=415).

non-local questions (mean=13.23; SD=3.14). This difference was statistically significant at an alpha level of 0.05, $t(376)=2.125, p=0.034$, with Cohen’s $d=0.23$, which suggests a small effect size. Thus, in a collaborative chat reference where multiple libraries are participating, patrons who ask local questions tend to be less satisfied with the service than the patrons who ask non-local, generic questions.

8. Discussion

8.1. Question types

The findings of the present study showed that public library patrons pose various types of questions to the inter-institutional collaborative chat reference service as shown in Table 1. The 14 question types could be compared with the taxonomy of questions compiled by Pomerantz (2005) from his comprehensive review of the reference service literature. The taxonomy includes 11 types of questions, including directional, holdings, ready reference, exact reproduction, description, readers advisory, bibliographic instruction, research, citation list, analysis, and critique. While most question types in the taxonomy were also observed in the present study, certain types of questions, such as circulation-related questions and patron account access, were more frequently observed than other types.

Table 2
Answer completeness: local versus non-local questions

Question types	Completely answered		Partially/unanswered		Referred		Problematic ending	
	n	%	n	%	n	%	n	%
Local questions (n=231)	107	46.3	6	2.6	102	44.2	16	6.9
Non-local questions (n=147)	106	72.1	9	6.1	14	9.5	18	12.2

The proportions of the question types in this study could be further compared with previous studies. First, subject-based research questions comprised of more than one-quarter of the total transactions in the present study. This finding is consistent with [Arnold and Kaske's \(2005\)](#) report of a stand-alone chat reference at an academic library where 23% of the 419 transactions were subject searches. Notably, circulation policies and procedural questions were the most frequently occurring questions in the present study, comprising more than 50% of the total transactions. Many of these questions (e.g., “Can I renew videos online?,” “I am trying to place a hold and the system is saying I have an invalid ID number.”) were repeatedly asked questions. This high proportion of circulation-related questions was also reported from the members of the Association of Research Libraries ([Ronan & Turner, 2003](#)). Similar observations were reported by [Bradbury, Payne, Perrott, and Lunsford \(2002\)](#) where more than one-half of the chat questions were repetitive and 70% of their answers could be found in the library's Web site. The above comparisons of the question profile revealed that public library patrons' use of the inter-institutional collaborative chat service is not drastically different from those who use the stand-alone chat service at the academic library. The identified profile of questions could help train new staff and develop a Frequently Asked Questions (FAQ) database or a knowledge base.

8.2. Overall effectiveness of question answering

Answer completion rate across all question types was 56.4% in the present study, which is considerably lower than the reports of two previous studies of chat service at a single academic library. According to [Kibbee et al. \(2002\)](#), the answer completeness, measured by the patrons' perception, was considerably higher: approximately 90% of 130 respondents perceived that the completeness was very good or excellent. [Ward \(2004\)](#) reported that the general answer completion rate of chat reference is as high as 70%. The reasons of the lower answer completion rate in the present study were undetermined. It may be due to the strict measurement of answer completion of this study where referrals and partial answers were not included as completed answers. Or, it may be that the answer completion in the inter-institutional collaborative service at a public library setting is actually lower than that the stand-alone service of academic libraries. Interestingly, this 56.4% answer completion rate of the present study is more compatible to [Heron and McClure's \(1986\)](#) 55% reference success rate that was measured by answer accuracy. Nonetheless, the reasons of the lower answer completion rate should be further scrutinized.

The present study also showed that patrons of the public library system were largely satisfied with the collaborative chat reference service: 65.2% of the respondents were satisfied with the answer they received, 68.2% of the respondents answered the librarians' quality of handling questions as being excellent, and 77.2% of users answered that they were very likely to use the service again. This result generally consolidates the findings of the aforementioned study of [Pomerantz and McClure \(2004\)](#). It reported the high level of satisfaction among the chat reference users of a North Carolina county library system participating in a nation-wide chat-based reference consortium.

8.3. *Effectiveness of question answering: simple factual versus subject-based research questions*

The claims about chat reference's possible inefficiency in handling subject-based research questions were not supported in the current study (Kibbee et al., 2002; Lee, 2004; Nilsen, 2004). Subject-based research questions, when answered, were answered as completely as factual questions and found to be the question type that gives the greatest satisfaction to the patrons among all question types. Although subject-based research questions may involve reference interviews and bibliographic instruction during patron–librarian interactions, patrons seem to be most appreciative once questions were answered. These findings suggest inter-institutional chat reference is a proper channel to answer subject-based research questions. Thus, the present study supports the assertion of Kern (2004) who argued that limiting digital reference service to ready reference questions alone would not adequately meet user needs and may not even be understood by those users who do not understand the service mechanism of a consortium. Indeed, answering complex questions can be further improved with the advance of technology, such as VoIP, which assists interactive communications.

8.4. *Effectiveness of question answering: local versus non-local questions*

Probably, the most notable phenomenon revealed in the present study is the ineffectiveness in handling local questions in the inter-institutional chat reference service. Constantly, local questions were less completely answered compared to non-local, generic questions. This ineffectiveness suggests a gap between patrons and librarians in their understanding of collaborative reference services. Patrons constantly brought questions that required checking on their library accounts. The following excerpt from a transaction transcript shows an incident:

Librarian: "This is a cooperative service, so you have reached a librarian in Pasadena, CA!"

Patron: "OH! I thought it was our local library! Sorry!"

Librarian: "We could try it together or I can refer you directly to the library. I cannot check patron's information online."

As evidenced in the conversation above, many patrons interacting with *outside* librarians appeared to think that they were chatting with their *local* librarians and therefore asked to check their library accounts. Every time this occurred, librarians had to explain to those patrons that the service was being answered by librarians across the country. Then, the librarians referred the patrons back to their local libraries with a contact telephone number in an effort to resolve the problem. Patrons who were not initially aware of the cooperative nature of the chat reference service expressed, "It would be more helpful if the operator was affiliated with the library. They were helpful, but unable to answer questions because they could not have access to my record," in the open-ended comment in the exit survey. Quite different from the patron's aspiration, a librarian attempted to correct the patron's perception of the nature of the cooperative service by stating, "[this 24/7 service] really isn't meant to focus on specific branch library issues. We are geared more for answering general reference questions." This

statement not only reveals the librarian's view of the collaborative service but also shows the discrepancy in the understanding of the nature of the collaborative service between the patron and the librarian. If this collaborative service is truly meant to go beyond a local library, the questions should be answered completely and seamlessly by outside librarians, and the patrons should be satisfied to the same degree as if they were answered by their local library staff. If the collaborative service does not intend to answer local questions, the patrons should not even be directed to the service from the outset. Otherwise, this problem could continue to be a critical source of confusion and frustration for the patrons using the inter-institutional collaborative chat service. By identifying the localness of a question as another important criterion to classify questions, this finding augments the findings of a Delphi study where question type was identified as an important criterion to distribute questions in an automated question triage system or question assignment and routing system for digital reference consortia (Pomerantz, Nicholson, & Lankes, 2003).

Furthermore, it should be noted that circulation-related questions were rated as the question type that received the second lowest satisfaction from the service users (Fig. 4). This finding may be explained by the fact that a large proportion of circulation questions were referred back to the patrons' local library because the question required access to patron accounts by authorized personnel. Considering that the user satisfaction with referrals was generally low (Kwon, 2006), a question distribution system should be designed in a direction to minimize those unnecessary referrals.

Another notable finding of the current study is that inter-institutional chat reference handled complex, subject-based research questions more effectively than simple procedural or policy questions that required the use of local resources to answer the questions. These findings suggest that the volume of local questions is important managerial information for decision making when a library considers joining an inter-institutional reference consortium. If a local library deals with a high proportion of questions that are answerable by its locally restricted resources and services only, joining the consortium would not be recommended. Conversely, if most reference questions do not involve local knowledge or resources, or if those local questions are answerable by outside librarians successfully, the library will benefit by joining a consortium. Furthermore, the local library could develop and implement service policies based on a thorough understanding of the question profile of their own library.

Based on the above discussions, a useful question typology for an inter-institutional chat service can be classified into the following three groups:

- globally answerable general questions (e.g., factual, subject search, ready-reference, resource use);
- globally answerable local questions (e.g., local library services and programs, staff contact, remote transactions for circulation and interlibrary loans); and
- locally answerable library-specific questions (e.g., patron account access, locally restricted database access).

Reference consortia as well as local libraries could adopt this typology in order to manage question traffic on their Web site and to develop an automated question triage system.

9. Limitations and future research

Limitations of the present study could be addressed along with an agenda for future research. First, the present study investigated the collaborative chat reference experience of a single public library system, although the librarians observed for this study were affiliated with 49 library systems across the nation. In addition, this study reports the case of one consortium, the Metropolitan Cooperative Library System (MCLS) that used 24/7 Reference application. The findings of this study might have been affected by the policies of the consortium and software capability selected for this study. Thus, the findings should be further validated by further research conducted at different public library systems and consortia using different software applications.

Another limitation is the fact that the transactions analyzed for the present study represent 30.1% of the total transactions made during the study period by opting patrons who participated in the exit survey. Although this level of response rate is not uncommon in the survey research, it should be noted that the patrons who completed the questionnaire may be different from those who did not. Because the survey participants may not accurately represent the entire population of the study, the findings should be substantiated by further research.

10. Conclusion

As Pomerantz (2006) properly states, “Reference work ... is not one of the arenas in which libraries have traditionally formed consortia” (p. 49). The current study is an empirical effort to help the formation of effective chat reference collaborations by investigating question-answering effectiveness across different question types. While the present study reports relatively high levels of user satisfaction and 56.4% of answer completion rate, the findings suggest room to advance the service. Revealing the problem of handling local questions, the present study informs that the capability of a consortium to handle *local* questions is directly related to the success of inter-institutional reference collaborations. This finding suggests a more effective assignment and routing of those repeatedly occurring questions using automated question distribution systems or triage systems. Furthermore, the fact that one quarter of the total inquiries fell into subject-based research questions also calls for a more systematic question distribution system to link to the subject experts, which will inform the emerging research on automated question triage systems.

The present study provides implications for reference consortia to devise effective policies that can facilitate co-ordinations among member libraries. According to the findings of this study, the service policies should be implemented based on a thorough understanding of question type. Accordingly, a useful question typology was proposed to classify the questions by locality (i.e., globally answerable general questions, globally answerable local questions, and locally answerable library-specific questions). Such typology should help with preparing guidelines for their member libraries so that certain questions do not travel outside the patron’s local library. Additionally, consortia should find a way for proprietary resources in a direction to maximize the collaborations.

Implications of the findings for local public libraries are manifold, including optimal coordination of various modes of reference service channels, library Web page interface design, and staff training. More specifically, an accurate estimate of the volume of local questions in a local library could serve as useful managerial information, which would help the library decide whether it should go global or remain local. In addition, the high level of user satisfaction in subject-based research questions suggests that librarians should continue to sharpen the skills for question negotiation on chat reference. Thus, staff training tools, such as [RUSA behavioral guidelines \(2004\)](#), could be utilized to train staff for developing effective reference interviews.

Public libraries in the digital era are grappling with issues related to integrating their digital and traditional services. Facing such challenge and the increasing user expectations in the digital era, public libraries should be able to prepare a complete reference service package by coordinating diversified service delivery channels from a user-centered perspective, and chat reference will be an important part of the package. Public libraries will be able to design such service package by understanding both the behaviors of the service users and constant monitoring of question-answering effectiveness.

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