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Chat Reference Service at Umeå University Library A Content Analysis of Transcripts

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Abstract:

This study focuses on virtual services and more particularly on the usage of chat services to provide a formal evidence of the status of one particular chat reference service. It explores the efficiency of the chat service model at Umeå University Library for the period August 2015 to February 2016 and covers a total of 221 virtual chat transactions. It uses content analysis and a process model of chat-based reference to bring comprehension of the content for both inquiries and replies to understand the usage of this service and discern trends and discrepancies. The results show that September and February have the highest amount of questions due to the distribution of the academic year. Furthermore, the requests appeared to be spread evenly over the distinguished categories with a slightly lower number of research related questions which reflect the difficulty to perform a reference interview in the virtual context. The study uncovered that the types of inquiries affect the level of completeness and consequently questions requiring general knowledge of the library are more successfully answered than more specific questions. The referrals are connected to the knowledge area of the librarian answering the chat and remain internal. Those results can be easily improved through skill development programs but librarian evaporation remains a predominant issue that should be addressed. Despite the circumstantial attendance of the chat, the chat service appears to be a valid alternative to the information desk and the library management should improve the chat efficacy by involving more competences.

Keywords: chat service, information request, referral, answer completeness

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Table of Contents

1. INTRODUCTION	1
1.1 DIGITAL REFERENCE SERVICES	2
1.2 CHAT REFERENCE SERVICES	3
1.3 EVALUATION OF CHAT SERVICES	4
1.4 PROBLEM FORMULATION	4
1.5 AIM	6
1.6 RESEARCH QUESTIONS	6
1.7 DISPOSITION	7
2. LITERATURE REVIEW	8
2.1 CLASSIFICATION OF INCOMING QUESTIONS	8
2.2 ANSWER COMPLETENESS	10
2.2 REFERRAL	12
2.4 SUMMARY	13
3. THEORETICAL TOOL	14
3.1 DISCUSSION ABOUT THE PROCESS MODEL OF CHAT-BASED VIRTUAL REFERENCE	15
3.2 APPLICATION OF THE THEORETICAL TOOL IN THE PRESENT STUDY	17
4. METHOD	18
4.1 METHODS USED FOR DATA COLLECTION AND DATA ANALYSIS	18
4.2 DATA COLLECTION	19
4.2.1 <i>Process</i>	19
4.2.1.1 <i>Question classification</i>	19
4.2.1.2 <i>Answer completeness</i>	20
4.2.1.3 <i>Referral</i>	21
4.2.2 <i>Pilot study</i>	21
4.2.3 <i>Final coding for the chat transcripts</i>	22
4.2.3.1 <i>Question classification</i>	22
4.2.3.2 <i>Answer completeness</i>	23
4.2.3.3 <i>Referral</i>	24
4.3 ETHICAL ISSUES	24
5. EMPIRICAL CONTEXT	26
6. RESULTS AND ANALYSIS	29
6.1 CLASSIFICATION OF INCOMING INFORMATION REQUESTS AND CHAT SESSIONS	29
6.1.1 <i>Monthly chat sessions and monthly conversations</i>	29
6.1.2 <i>Monthly incoming information requests</i>	30
6.1.3 <i>Classification of incoming questions</i>	30
6.1.4 <i>Types of information requests per month and over the study period</i>	31
6.2 ANSWER COMPLETENESS	33
6.2.1 <i>Incomplete and complete sessions and questions</i>	33
6.2.2 <i>Monthly chat session complete and incomplete distribution</i>	33
6.2.3 <i>Incomplete question per question category</i>	34
6.2.4 <i>Monthly incomplete chat conversation distribution per question category</i>	35
6.2.5 <i>Causes for incomplete chat sessions</i>	36
6.2.6 <i>Causes of incomplete chat sessions per question category</i>	36
6.3 REFERRALS	37
6.3.1 <i>Total amount of referrals</i>	37
6.3.2 <i>Referrals destination over the study period</i>	38
6.3.3 <i>Referral destination per month</i>	38
6.3.4 <i>Questions category and referrals</i>	39
6.3.5 <i>Referral destination per question category</i>	40
7. DISCUSSION	41
7.1 CLASSIFICATION OF INCOMING INFORMATION REQUESTS AND CHAT SESSIONS	41

7.1.1 Monthly chat sessions and monthly chat conversations	41
7.1.1.1 Chat sessions distribution	41
7.1.2 Classification of incoming questions.....	42
7.1.2.1 Question submission	42
7.1.2.2 Circulation policy and account related questions	43
7.1.2.3 Holdings	44
7.1.2.4 Research paper and examination period	44
7.2 ANSWER COMPLETENESS.....	45
7.2.1 Incomplete and complete chat sessions and questions	45
7.2.2 Incomplete questions per question category.....	46
7.2.3 Technical problems	46
7.2.4 Student and librarian evaporation.....	47
7.2.4.1 Student evaporation	47
7.2.4.2 Expert selection and librarian location	47
7.3 REFERRAL.....	48
7.3.1 Total amount of referred questions.....	48
7.3.2 Referred question categories.....	49
7.3.3 Referral destination	49
8. CONCLUSION	50
8.1 LIMITATIONS.....	50
8.2 FUTURE RESEARCH	51
REFERENCES	52
APPENDICES	58
APPENDIX A: CLASSIFICATION OF INFORMATION REQUESTS WITH EXAMPLES	58
APPENDIX B: CAUSES OF INCOMPLETE ANSWERS WITH EXAMPLES	59
APPENDIX C: REFERRAL DESTINATIONS WITH EXAMPLES	60

1. Introduction

Reference services date back from the late nineteenth century and present the librarian as an information provider, an instructor or a helper (Bopp & Smith, 2001). The first digital reference service started in the mid-1980s and was called Electronic Access to Reference Service (EARS). It provided information to users through emails by the University of Maryland Health Science Library and the Health Science library at the University of Washington (Still & Campbell, 1993). By the end of the 1990s several companies started developing software for reference purposes and in 2002 the Library of Congress with OCLC opened a collaborative reference service in 2002, called QuestionPoint (Zanin-Yost, 2004).

As internet has spread into homes and offices, it is widely known that the endorsement of information and Communication technology (ICT) has led to opportunities but also challenges to the traditional library sector (Liu, 2007). Libraries have gained users and using the internet to reach them has allowed the libraries to enter their private spheres. The growth of the internet has also impacted the academic libraries and its clients with the influence of search engines and new ways to retrieve information (Kaur & Singh, 2011). The transition from desk reference to online reference has affected the way users search for information. The patrons expect more quality from a library service (Singh, 2003). To compete with Google, academic libraries had to concentrate on value-added services of information retrieval in order to approach the evolving needs of the patrons (Brett, 2003). As LeBoeuf described already in 2000, library services have several attributes: As customer services, they facilitate access and information retrieval but more importantly, they aim at helping customers to find what they want and to feel satisfied about the interaction.

Even though the computerization of the society is well-accepted, virtual reference is still a new concept in Europe, as opposed to the USA where it has been in place for twenty years (Liu, 2007). Liu suggests that, supporting the library management and improving a service quality, it is recommended to establish the status of such a service through an evaluation. This contributes to the knowledge development of the personnel and lead to a more effective institution.

Unfortunately, most evaluation projects target other services than the digital ones. This present research has offered an opportunity to participate in knowledge development of chat reference services in Sweden. Under the microenvironment of a university library in the north of Sweden, this work can set out the different requests coming to the chat service and dissect the chat sessions in order to find out the favorable outcomes of such a service. This thesis based on the examination of a reference service tries to shed light on the use of such a service by the patrons in order to understand what questions the information provider meet on a daily basis and if this service is fulfilling its goal by answering the incoming requests. By reporting the results of the research, the author aims to provide a basic understanding of the chat reference service in a local university library in Sweden and participate to its optimization.

1.1 Digital reference services

In the United States of America, digital reference services have become standards from the small libraries to the large institutions, whether it is an email service or an advanced delivery system (Liu, 2007). Digital reference services are more than “a reference service without a desk” (Liu, 2007, p 16). It is the consequences of the increasing development of information and communication technology in the world. It is the expected evolution of the library facing the modern lifestyle and new needs of users using the digital platform for work and communication (Liu, 2007). Digital reference services are said, explains Liu (2007) to enhance traditional reference service by expanding the range of expertise. It does not replace face-to face reference but contribute to a higher quality library service and supports the five laws of library science (Ranganathan, 2006 [1931]). Based on the knowledge and user familiarity with human-mediated information-seeking assistance, virtual references connect users to the people who can find answers to their questions and support the development of knowledge by offering an expert support in a variety of areas (Liu, 2007).

Janes (2003, p 29) defines Digital Reference Services (DRS) as “the use of digital technologies and resources to provide direct, professional assistance to people who are seeking information, wherever and whenever they need it”. Pomerantz (2003, p 36) states that it is “a human-intermediated assistance provided to users via electronic media in fulfillment of users’ information needs”. Tettegah and Hunter (2006, p 172) conclude that it is an “internet-based question-and-answer services that connect users with experts and subject experts”. The development of technologies has led to the diversification of the possibilities in the field of digital reference. Each form of digital reference has pros and cons but they all have the same goal which is to help the users quickly and from distance regardless of the time and the users place. The types of references services include email and chat services, web forms and web contact centers, Voice over Internet Protocol (VoIP) and video conferences (Rosch 2003).

Digital Reference services are divided in four varieties, explains Berude (2004): first, *asynchronous* or email based reference service. Second, *Synchronous* such as chat is based on text and real-time interaction. Third, *Video reference*, also synchronous but it is based on audiovisual interaction through webcams or video conference device, and fourth, knowledge-based databases combined with advanced search engine through a *robot*. All those forms of interaction require the expertise of a librarian except the last one. Synchronous and asynchronous indicate the time elapsed between a request and the response. The synchronous model refers usually to chat and video software allowing the user to place a request directly to an information specialist, leading to a real-time dialogue in a single time session frame. The asynchronous model is usually based on web forms and emails when the user sends a request to the library and a librarian answers within a time gap.

Berude (2004) divides the chat reference in three categories. She calls the first one *Virtual Reference (VR) and Information Service*. It is based on real-time reference, directly on the internet through chat, voice or videos. The second

one is called *Digital Reference or Information Service* and comprises all the form of reference on the internet including the reference forms such as emails, web forms and VR. Finally, *the Integrated Digital Reference* is composed of any combination of the online reference services types offered by one individual or collaborative service and usually includes telephone services. A digital reference session usually includes a patron, an interface in the form of an online form or email, contact, an online chat or a video chat and an information expert (Berude, 2004).

1.2 Chat reference services

Matesson et al. (2011, p 172) define chat reference services as “a synchronous, computer-mediated communication between library staff and library users”. It is said to be one of the most effective ways to deliver information to remote users (Liu, 2007). Librarians usually agree that it is a service available to all the users who need assistance from a distance but there is a controversy when it comes to decide whether it simply is “an add-on to the reference service in person or an integrated service connected to the evolution of information culture” (Meert & Given, 2009, p 72). There are also many discussions about its necessity as a service. Some librarians see it as a necessary development in today’s society and other think it is highly overrated (Meert & Given, 2009).

Chat reference might be the easiest way to ask a question and obtain an instant answer for the user. But it presents a challenge for the user who has to be patient while the librarian is typing or asking for more information to ensure the best response possible. Compared to desk reference, the librarians feel pressed to answer quickly and effectively, often disregarding the traditional reference interview process (Liu, 2007). This form of service presents other limitations. For example, the librarian cannot read the verbal and non-verbal cues or the facial expression, explains Wikoff (2008). The communication offers no clue through voice tone, body language or facial expressions. It can lead to mistranslation and misperception when the librarian cannot assess the psychological state of the user. For example, a user making many mistakes can be in hurry but the librarian thinks that this user has poor chat etiquette or a user not writing back might have disappeared or does not understand what the librarian explained but does not want to impose or feel stressed. Besides, the librarian cannot offer exhaustive instructions to the users as everything has to be written down and it is time consuming for both persons involved (Wikoff, 2008).

The advantages of desk reference service above all other form of communication is its interactivity. The librarian can read the face; hear the tone of the voice and the silences, understand the tempo of the voice expressing different emotions from the user. It simplifies guided bibliographic instructions and reference service in all its aspects. But some features added to the chat can make it more user-friendly (Wikoff, 2008). Some chat services offer co-browsing or screen sharing in order to assist patrons from distances, accessing their computer and guiding them live from their own computer (Lankes, 2003). Some digital services automatically send an email to the user with the chat transcript after the transaction and sometimes, some librarians can reach the

users through emails if the chat got interrupted. Some software have features that also support the librarian work (Matesson, Salamon & Brewster, 2011) such as pushing webpages, storing written messages to use as scripts or statistics and reports helping the management improving the service. Depending on the other alternatives for the user, the chat allows remote users to have an instant interaction with the library. It can facilitate the interaction for those who have scheduling issues and cannot be at the library premises during opening hours. It is an ideal option for the users who need to remain anonymous due to privacy concerns. It can offer an alternative for users who need to overcome the language barrier. It is a positive substitute for disabled people who suffer from anxiety, hearing or vocal impairment and an option for handicapped people with mobility challenges (Matesson et al., 2011).

1.3 Evaluation of chat services

Evaluation of library reference services started in the 1970s due to budget planning in the library world (Pomerantz, Luo & McClure, 2006). Since then, libraries always had to juggle between offering better service while facing budget reduction. In order to find an economical solution while offering a meaningful service, evaluation of services has been an ongoing process leading to recurrent standardizations and staff training.

In the evaluation perspective of a chat reference service, there are many areas that can be researched (Meert & Given, 2009). Saxton and Richardson (2002, p 33) review the measures used to evaluate the library reference service and conclude that the majority of the studies focused on two main aspects: “testing the accuracy of answers to reference” or “testing the level of satisfaction of the users” which reflect the two main goals of the reference service: the service quality and the patron satisfaction. As the main goal of a service, it is to meet users’ needs; the patron satisfaction can be translated into recurring users and an increase numbers of users while the service quality refers to several areas related to the technology used and the information provider.

Whitlatch (2000, p 2) suggests four main areas of concerns when evaluating a reference service: the economic aspect, e.g. cost effectiveness, productivity measure; service process, e.g. measures of satisfaction with the service provided; resources, e.g. measures of quantity and quality of materials, staffing, equipment, and facilities supporting the service; and service outcomes or products, e.g. measures related to the quality of answers or information delivered.

1.4 Problem formulation

As Fullerton (2002, no pag) states, “the unique nature of digital reference introduces a new realm of issues and challenges”

The reference interview is one of the major points that the librarian attending a virtual chat has to manage. The context of the chat reference does not provide

the same circumstances of the desk reference but remains a personalized service. The information provider has to perform a reference interview to ensure the success of the reference transaction (Liu, 2007). To provide a successful and positive reference interview, the information provider needs to develop some skills such as being able to analyze the referred question, perform a satisfying interview, establish a search strategy and provide the right information (Katz, 2002) so protocols have to be developed to facilitate the interaction and ensure the success of the reference process (Tyckoson, 2003).

There are also concerns linked to the user privacy as the user accessing the library online service can be traced back through IP addresses by trackers, other individuals and companies willing to exploit any data available on the internet (Neuhaus, 2003). Then, the question of data records and archiving on the library server and its value can lead to legal contentions as there is a divide between destroying the files under the clause of protecting the privacy or keep them for study purpose or historical value (Neuhaus, 2003).

There are barriers linked to the context of the chat service. Digital reference services are “by design” remotely accessible. Patrons are acknowledged but invisible to reference librarians (Greenberg & Bar-Ilan, 2015). Consequently the information provider has to remain approachable, and focus on what the information seeker is trying to say and have access to a solid online resource to facilitate the support work and ultimately provide an appropriate follow-up (Ronan, 2003). Having access to a “virtual ready reference collection” (Liu, 2007, p 40) should be the first step when planning a virtual chat service as it supports the reference work and make the user more independent (Liu, 2007).

Digital reference is a very complicated service that requires techniques and funding, staff and users. In order to ensure its quality and endurance it is recommended to develop and maintain guidelines (Liu, 2007). As it is time-consuming to create guidelines, some recognized institutions have created guidelines to support the development of digital reference. The International Federation of Library Associations and Institutions (IFLA) and its division, Reference & User Service Association (RUSA) have developed several guidelines focusing on different aspect of the digital reference service. As a result, most institutions use those guidelines as the bone structure of their locally developed regulations and recommendations.

Chat services have been introduced as a communication medium offered by several university libraries in Europe in the course of the early 2000s due to the intrusion of the internet in the private and public sphere. However the amount of literature describing online reference services and more particularly chat services is not very large in Europe. This investigation could provide some insights about the development of digital services in the Nordic countries.

This study explores the chat service model of Umeå University Library. Despite statistics about the use of the chat service, no in-depth evaluative measures have been undertaken. It appears relevant to try to discover what information requests come to the chat service and how completely the inquiries are answered in the synchronous virtual context and whether the staff is deployed efficiently to maintain a consistent level of service.

1.5 Aim

The aim is to contribute with extended knowledge on virtual services and principally on the usage of the chat service at Umeå University Library.

The study offers an in-depth analytic description of the investigated service. It tracks the reference transactions and screens the incoming questions to discern recurring themes and digressions in the Umeå University Library collection.

Through the description, this study can support the maintenance and development of the chat service and other services linked to it. It can support directional decisions concerning staff training and reference policies regarding the information needs of the virtual service users and decisions about the development of the collection.

1.6 Research questions

The study is guided by the following questions:

What types of requests are coming during the chat sessions?

How are these information requests dealt with?

What questions and requests are referred and to whom?

The focus of the thesis is on the content of the chat service transaction. The aim is to study the reference encounter during the sessions. The researcher looks at the transcripts of the chat reference transaction in order to explore several areas. Transcripts analysis and categorization is effective to examine a wide range of perspectives in a digital service, such as the question area, the characteristics of the answers, the interaction, etc. (Burger, Park & Li, 2010).

The first question classifies the questions by types allowing for an understanding of how the service is being used and to find out what types of users' questions are coming to the chat reference service.

The second question focuses on the librarians' answers and more particularly on the outcomes of the chat session as a whole. The researcher wants to find out how many chat sessions terminated with the users receiving a complete answer to the request and by so being completed or if the user was invited to contact another service or person and by so being referred.

The last question specifically examines the extent to which questions are referred, the types of questions that are more likely to lead to a referral and if the amount of those questions is consequent enough to reconsider the staff working with the chat service.

1.7 Disposition

Chapter 1 gives a background to the study, the statement of the problem, the purpose of the study and the research questions.

Chapter 2 examines literature relevant to the study, focusing on the classification of the incoming questions, the answer completeness and the referrals in previous studies.

Chapter 3 discusses the General Digital Reference Model from Pomerantz (2005) used as a theoretical tool in this study.

Chapter 4 describes the methods used in the thesis and the data collection, the pilot study and the coding used in this study.

Chapter 5 describes the background of the study. It provides information concerning the historical background of the chat service at Umeå University Library. It presents figures linked to Umeå University and its university library in 2015.

Chapter 6 presents the findings of the study and the analysis. It is divided in three main sections following the research questions.

Chapter 7 discusses and interprets the research findings for the three research questions and offers suggestions to improve the efficiency of the chat service.

Chapter 8 presents the conclusions, the limitations of the study and suggestions for future research.

2. Literature review

The literature review follows the division of the three questions studied in this thesis in order to support the choice of categorizations developed for each category.

2.1 Classification of incoming questions

In the library world, questions have been classified as either reference or non-reference so Derr (1984) created a categorization comprising (p 186-190): existence, identity, properties, relation, number, location, time and action. This system is limited and only effective on ready-reference. Greenberg and Bar-Ilan (2015) use the classification system developed by Schwarz (2004), Moeller (2004) and Mann (1999) to analyze what the users are asking when contacting the virtual service. Their categories include: in-depth questions, short and quick answer questions, instruction and policy. This form of classification does not fit the actual study as the focus of Greenberg and Bar-Ilan (2015) seems to be on the outcome of the question and not on the content of the question itself. Nevertheless the outcomes of the chat sessions in their study (p 143) showed that a considerable amount of questions (42%) were short questions.

McClure, Lankes, Gross and Choltco-Delvin (2002) have developed a comprehensive guideline to support the evaluation work of digital reference services. They suggest fourteen descriptive measures and statistic methods to assess the digital transcripts and nine categories to classify the incoming requests from the patrons (McClure et al., p 24-25): bibliographic, instructional, literature search, other, out of scope, reader's advisory, ready reference, research or subject request and technical, but most of the past studies used codes based on Katz (2002). The reference questions are divided in several categories such as directional, ready reference, specific search and research.

Katz (2002) differentiates the request for ready references and the more in-depth questions. Automatic information retrieval is considered a simple transaction between the clients and the librarian where the latter already knows the answer, for example policy or procedure which can fall under the first category, directional. The second category, ready reference refers to a simple action from the information provider to refer to a FAQ, an encyclopedia and other links for example to answer the request. The last category is a multi-step transaction where questions necessitate the use of bibliographic supports such as the catalogue and databases, bibliographies and abstracts (Katz, 2002, p 200).

When reviewing literature to uncover the success of the large academic library with several reference departments and subject specialists at the University of Illinois at Chicago (UIC) in March 2003, De Groote, Dorsch, Collard and Scherrer (2005) present nine different research works between 1996 and 2003

(p 439). They underline that all the different research works about incoming question at a chat reference service had different question categorizations.

In 2008, Luo created a framework based on various studies (between 2001 and 2007) about chat reference questions and most studies used Katz's work from 2002, and build upon more categories (Luo, 2008, p 74):

- Questions about library policy or service procedures
- Requests for assistance in using library resources or services such as e-resources (e.g. Database), circulation, etc.
- Questions about local or non-local resources in a collaborative reference service
- Questions about technical problems
- Questions about chat reference service itself

A systematic review of research on incoming questions in live reference was presented by Matteson et al., (2011). Most of the studies (between 2003 and 2008) built their coding on one another which implies that the Library and Information Science (LIS) community has not defined authoritative guidelines for coding schemes that could be used for cross-institutional researches.

This review was confirmed by Morais and Sampson (2010) and Arendt and Graves (2011) who explain that there is no consensus about the question codification for reference chat service transcripts. As consequence, researchers have elaborated numerous methods of categorization which obstruct cross-studies work. Despite the fact that the coding varies from study to study, it was noticed that some question categories were recurring such as: "reference, specific search/known item, policy/procedure and information/directional" (Matteson et al., 2011, p 179).

Morais and Sampson (2010) examine the transcripts from the University of Minnesota libraries between January and May 2003 and 2004 and students usually used the online support to find assistance for specific items. And Goda and Bishop (2008) uncover that questions about policies and library cards peak at the beginning of each term when studying 4 154 chat transcripts to understand the "frequency and content of the chat questions by time of semester" (p 291) at the University of Central Florida for the period January 2005 to May 2006.

Marsteller and Mizzy (2003) studied the first full year of chat reference service at the Carnegie Mellon University in Pennsylvania for the period October 2000 to September 2001 and classified 865 transcripts according to the patrons' questions as following: reference, directional/policy, facts/ready reference and known item as they researched previous studies and concluded that the lack of standardization forced them to come up with their own design.

2.2 Answer completeness

For many years, unobtrusive studies of reference transactions were performed using standard questions asked by trained personnel. The quality standards suggested by Lankes, Gross and McClure (2003) include the following criteria to assess digital references quality: courtesy and accuracy, users' satisfaction and repeated users, awareness and cost, completion time and accessibility (p 60-61). White, Abels and Kaske (2003, Introduction, paragraph 2) explains that "the outputs or responses to actual questions [...] are more difficult to evaluate [...] user satisfaction is often used as an acceptable surrogate".

In contrast, the study performed by Arnold and Kaske (2005) of reference transaction at the University of Maryland, College Park, between January and September 2002 examines 351 chat transcripts to determine the incoming questions and the answers. The responses are categorized following a large spectrum for two main points ranging from:

- *correct and complete and with reference cited to not correct and with no reference cited*
- *questions deferred, referred, or Lost because of technical problems*

Arnold and Kaske's (2005, p 188) results show a total of approximately 92 % of correct answers for 8 % of wrong answers. Although almost 28% of the total questions were reported as deferred, referred or lost (p 182). Maximiek, Rushton and Brown (2010) followed a modified Arnold and Kaske (2005) model to analyze a virtual reference service at Binghamton University. They use a scale from: correct and complete, correct but not complete, not correct but complete, not correct and not complete and the results show 84% of questions being answered correctly and 7% incorrectly (p 366). Radford and Connaway (2013) used also modified categories from Arnold and Kaske (2005) and added two extra categories "incorrect (without specific information requested, with only general/related resource) and other" (p 5) to study randomly selected VRS transcripts (one of 850 live chat sessions from 2004 to 2006 from QuestionPoint and QuestionPoint 24/7 Reference Service, an international QuestionPoint (OCLC).

Ward (2004) analyses the effectiveness of the chat service when answering short, subject based research questions at the University of Illinois' "Ask a Librarian". The unobtrusive study covers 856 chat received in April 2003. The RUSA Guidelines for Behavior Performance of Reference and Information Service Professionals under section 4.0 Searching was used. It distinguishes principles for four essential parts: question negotiation, instruction 1 and 2 and follow up (Ward, 2004, p 49). As no measures have been written to implement those principles, Ward (2004) establishes a code system for each question ranging from: complete, mostly complete, mostly incomplete, incomplete and referral (p 49). He concludes a 47% of complete transactions. This is considered shortcoming when Ward's (2004) results are compared to "the 55 percent Rule" in the reference literature implying that librarians answers correctly only 55% of the time. This theory was tested by Hernon and McClure (1986) during an unobtrusive study and 62% of the questions were answered

correctly and 38% were answered incorrectly. Nonetheless it is important to emphasize that when including the “almost complete” category to the “complete” in Ward (2004, p 50), the result increased to 79% of successful transactions.

Kwon (2007) investigates the question completeness in an inter-institutional collaborative chat reference service system in the context of a public library system. The analysis is based on the transcripts and corresponding user surveys of 415 users. The answer completeness is based on RUSA’s Guidelines for Behavioral Performance of Reference and Information Services Providers’ proper closure following the four behavioral prescribed (RUSA, 2004). A transcript is either coded as *complete*, *referred* when the question was referred or *problematic ending* when the transaction ended prematurely. Kwon (2007, p 82) rated an overall 56, 4% of complete answers, 29% referrals, 9, 8% of problematic endings and 4, 8% of unanswered without referral (p 78).

Meert and Given (2009, p 79-80) compare the deferred answers in a chat consortia between the local university library staff and the consortia staff at the University of Alberta libraries, the third largest research university in Canada. A total of 477 transcripts, out of 2 983, were sampled for the period October 1st 2007 to April 30, 2008. The incoming questions were divided in four broad categories reflecting the content of the actual questions. The reasons lifted when a question was not answered in “real time” (p 76) was technical difficulties, no access to requested information, user need a subject specialist, referral needed, no time to answer the question. The non-answer rate was 11% for the local staff compared to 31% for the consortia personnel which reflects an improvement of competences in general in comparison to previous studies.

Fuller and Dryden (2015) evaluate the chat reference service at the University of Connecticut (Uconn) libraries. They analyzed all the transcripts from July 1st 2012 to June 30th 2013 for a total of 3 031 sessions. The accuracy category covers around half of the transcripts (1 916 items) for the questions category selected for further investigation. The accuracy was determined through a simplified pattern suggested by Radford and Connaway (2013) ranging from accurate-inaccurate and other. The answers provided by the librarian included relevant links and direction to sources were suggested. The inaccurate category concerns answers provided by the librarians where no specific or relevant information was offered and other category when the query was inconclusive. 93% of the answers were coded as accurate, 3% as inaccurate and 4% as other (p 174). Referrals were coded as accurate if sent to the appropriate institution or person.

Greenberg and Bar-Ilan (2015) apply the classification system developed by Schwarz (2004), Moeller (2004) and Mann (1999) focusing on how the librarians process the answer to the patron contacting the virtual service. Their types of answers include (p 143): no reply but the question was forwarded, tutorials and screen shots for explanation, informative answer, bibliography, full-text items, no answer available from the reference team, keyword suggestion for the search, reply: patron needs to clarify and last, partial answer. This model defines quite accurately the answer process.

The READ Scale (Reference Effort Assessment Data) presented by Kibbee, Ward & Ma (2002) examines the answer quality through a different angle than most of the studies focusing on analyzing the quality of the answer provided by the librarian. They discovered that questions related to the library services and finding known items were usually promptly answered as opposed to open-ended questions. Kibbee et al. (2002) concluded that the “failure to completely answer a question occurred because the staff member was unaware of the specific resources or services” (p 34).

2.2 Referral

In the current literature, several studies seek to identify the types of questions that are effectively replied in the context of the virtual service but few empirical studies research the proportion and types of questions leading to referral. This lack of studies can be connected to the wide acceptance of referral as a legitimate answer. Hawley (1987) presents the following definition for referral: “library referral is an act by library employees of responding to individuals’ needs by directing these individuals to another person, or to a place under the control of another person, for the fulfillment of these needs” (p 23).

Kwon (2006) studies the unmonitored referrals from a collaborative chat reference service. The analysis focuses on 415 queries including completed questionnaires, representing almost 30% of the total incoming requests and examines the types of question completed or referred. The study explains that referred questions fall into two categories: “expert research and re-directional local referrals” (Kwon, 2006, p 58). The expert research questions are forwarded to subject specialists and the re-directional questions are requests that require particular competences. The referral rate consists of 29% of the total transactions referred back to the local libraries, usually due to access restriction to the catalogue or the patrons account. Matteson et al. (2011) conclude also that the referrals in the consortia studied followed a foreseeable pattern. In a later study, Kwon (2007, p84) notices that 44, 2% of the local question and 9, 5% of non-local questions coming to a collaborative chat service are referred.

Wikoff (2008) studies the causes for transferring from chat to email services at a statewide collaborative chat reference service called the NCknows virtual reference service at the North Carolina library, and 33% of the 210 chat sessions lead to a referral to other librarians as the questions referred to holdings and user account, local library services and technical issues. Neuhaus and Marsteller (2002) analyze how librarians answered to the incoming questions at Carnegie Mellon University chat service and 30% of the responses are referrals and proxy referrals (p 36).

Van Houlson, McCready and Pfahl (2007, p 26) had a 38% of referral when analyzing 361 transcripts of the chat reference at the University of Minnesota Libraries-Twin Cities Campus for the periods January-May 2003 and January-May 2004. Arendt and Graves (2011, p 198) have comparable results (29%) when studying 1 891 chat transcripts from October 2004 to February 2010 at

the Southern Illinois University Carbondale's Morris Library. Gang et al. (2009, p 79) uncovered that less than 9% of the incoming questions require the expertise of a subject librarian and needed to be transferred. Fuller and Dryden (2015, p 175) evaluate the chat reference service at the University of Connecticut (Uconn) libraries and they discover that 18% of the questions require a referral: 47% are sent to a reference librarian, 38% to other services and departments and 16% to the electronic resource management.

2.4 Summary

Recognizing the necessity of chat reference evaluation, researchers and professionals have contributed to the advancement of knowledge through numerous evaluative studies of the chat reference services through the past decades. Those investigations were conducted by individuals or collaborative reference services. The goal of those studies often being to infer contrasts and generalizations.

The question classifications section presents the complexity of categorizing questions, explaining that they are usually build on each other due to the lack of standardization concerning the questions codification.

The answer completeness section explains the range of possibilities when analyzing the level of completeness of a chat answer. When reporting the results, it appears that the researchers tend to combine many categories or level of completeness to raise the total level of completeness.

The referrals seem to occur in both local and consortia chat services. They are a common practice to support patrons who need help that cannot be provided by the librarians attending the chat service.

3. Theoretical Tool

This study uses the digital reference model offered by Pomerantz (2005) (see figure 1) which originates from the work from Lankes (1998) and the Virtual Reference Desk Project (VRD)'s Ask A Software Specification Documents (Virtual Reference Desk Project, 1998) (Pomerantz, Nicholson, Belanger & Lankes, 2004). This process model focuses on the provision of digital reference services rather than on the user's information seeking pattern (Pomerantz, 2005). Lankes (2004) uses this model as a framework to explore digital reference as a system and "the mean by which technologies can be used to improve both the efficiency and the effectiveness" (p 306) of a system. When considering the digital reference model, it is acknowledgeable that this type of reference service uses technologies in order to improve the efficiency and effectiveness of the traditional reference service. This model consists of the following systematic elements (Pomerantz, 2005):

1. *Question submission*: consists of all the processes of gaining information from the information seeker. This procedure comprises the patron's questions, question categorization and user identification details through the technology used.
2. *Expert selection*: an information provider selects the request and the two individuals start to communicate through the chat service. In the context of consortia or multiple librarians attending the chat service, the *triage* is the assignation of a specific information request to a reference librarian. This moment is either computerized or performed under human directed decisions.
3. *Question negotiation and answer formulation*: the information seeker and the librarian have a discussion through the virtual tool. The information provider might proceed to do a reference interview with the patron. The librarian offers a reply to the user's request and/or some information resources. *Answer formulation* covers all the actions undertaken leading to an answer to a query, including forwarding the question to an expert or immediately to the patron.
4. *Searching resources*: the reference interview might lead the information provider to comb electronic and print information sources. These documents can be found in the forms of books, databases, websites or archives of preceding chat sessions.
5. *Archiving*: all the chat transcripts can be archived internally on the software itself or externally.
6. *Tracking and evaluation*: quantitative and qualitative studies support the analysis of many aspects of the chats such as the incoming questions and answers provided, the chat interaction, the users

demographics and several more content captured by the technology used.

7. *Resources creation*: tracking and evaluation data might be used to improve the collections and other information resources available to the information provider. *Resource creation* involves the exploitation of tracking data to adapt the library to the patrons information needs.

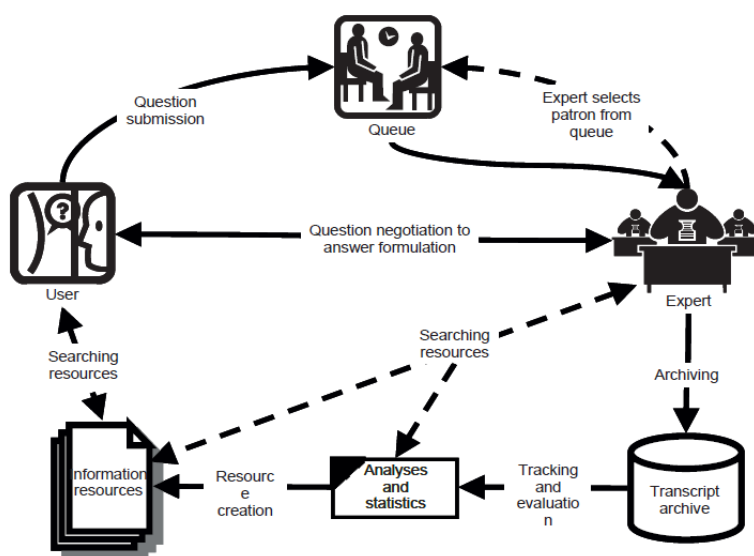


Figure 1: Process model of chat-based virtual reference (Pomerantz, 2005, p 1299)

3.1 Discussion about the process model of chat-based virtual reference

Question submission: the patron decides to contact the service, and then initiates the contact and asks a question directly and stays in the queue until a librarian selects the request. Taylor (2015) explains that a person determines how to solve an information need and decides for the method to achieve it. It means that before contacting the chat service, the patron makes an active choice to choose that particular service excluding the other possibilities. Pomerantz (2005) explains that opting for a chat reference service must be “as convenient a means for resolving information needs as asking a colleague or searching one’s own collections” (p 1290). As the chat reference services have developed the past decades and the Millennial Generation has grown up with the internet, this generation is very used to the means of digital chat for private communication and services purposes (Pomerantz, 2005). They are results-oriented when searching for information on the internet. They are familiar with Google and Wikipedia and expect prompt and complete answers to their information queries (Radford & Connaway, 2007). So using chat technologies can appear as convenient for them as any other way to obtain information.

Nonetheless their acceptance of such a service does not reflect its actual use (Pomerantz, 2005) and they remain a challenge for information service advancement (Connaway, Radford & Williams, 2009).

Expert selection: when a patron sends an information request, that individual enters a queue system. When the librarian logs on to the chat application, he/she monitors the incoming questions and makes an active choice to select that user who is informed about the active status of the request and the librarian and the patron can start a communication. Similarly to answering at the reference desk, in the circumstances of the chat service, the information provider has the duty to acknowledge every incoming question whether it is within or out of her/his competences and regardless of her/his interest to answer the request. Besides, in the chat context, the librarian can feel pressured to pick a user from the queue as the application indicates when someone is on hold (Pomerantz, 2005). Nevertheless it is not uncommon that some patrons submit a query but do not connect to the service personnel or are disconnected before the chat session is complete. The causes may vary from technical problems to the librarian not answering quickly enough or the user disconnecting due to time pressure or alternative possibilities (Sloan, 2003 as referred by Pomerantz, 2005)

Librarian location: there are debates about where the chat reference service should be located and accessed from. Some studies have considered the location of the chat reference service and Ronan and Turner (2002) found that the chat reference service was provided at the reference desk in 36% of the libraries studied (p 22). Kibbee et al. (2002) explain that the chat service was attended at the reference desk and the persons answering the chat would vary depending on the availability. Eitchler and Halperin (2000) clarify that the librarian has to multitask while attending both the reference desk and the chat service. Consequently, the amount of in-person request can influence the attendance of the chat service. It is agreed among libraries offering chat reference services that this service should be provided from a different location than the reference desk (Pomerantz, 2005).

Reference transaction: It is common knowledge among librarians that the opening question coming from a patron is an introduction to the actual request from the user. It may be a way to establish a communication with the librarian (Pomerantz, 2005). In the context of synchronous media, it is favorable to maintain a continuous exchange between the information provider and the patron, favoring the question negotiation process. The chat reference transaction is quite similar to face-to-face transaction as it is also two persons communicating with each other but it has also some similitude to the phone conversation as the user can be put on hold when necessary (Janes, 2002). Nevertheless Lynch (1978) explains that the librarians perform a reference interview in less than half of the reference transactions.

Archiving: It is common practice to record statistics about reference services and the characteristics of virtual reference allow storing data about the whole transaction unobtrusively. The data can be stored until intentionally deleted. Archiving chat data raises the question of user privacy and the context of chat-based service does not support the work of cleaning user data which can affect the adoption and the development of such a service (Pomerantz, 2005).

Tracking and evaluation: Durrance (1989) is among the first researchers to consider that the user satisfaction is as valuable as the accuracy of the retrieved information when evaluating a reference service. Sets of evaluation standards exist for desk-based and computer-mediated asynchronous reference services but no exhaustive guidelines or best practices are available for synchronous reference services (Pomerantz, 2005).

Resource creation: Pomerantz et al. (2004) suggest that tracking the reference transactions quantitatively and qualitatively allow screening the questions and identifying recurring themes and digressions in the library collections. Consequently the librarians can supplement information to develop the collection and other services related to the chat service in order to meet the information needs of the users.

3.2 Application of the theoretical tool in the present study

The process model of chat-based virtual reference by Pomerantz (2005) is used as a theoretical tool in the context of this research for the reasons that it offers a structure to analyze and understand the areas under study. The researcher aims at investigating the content of the queries and the replies in the context of the chat service in order to determine the efficacy of the chat service and this model is considered a relevant frame of reference. The model consists of seven elements however only four elements are used namely to analyze the data gathered:

- Question submission
- Expert selection
- Librarian location
- Answer formulation

The question submission consists of the initial contact from the patron which is the main concern of the first point studied. Secondly, the expert selection and the librarian location influence the initial interaction process between the librarian and the user and demonstrate how the circumstances can influence to some extent the outcomes of the chat sessions. Last, the answer formulation focuses on the outcome of the chat session. The process model by Pomerantz (2005) offers a broader perspective to the analysis by connecting each analyzed point together.

4. Method

This chapter describes the method used in this study, the data collection process and the ethical issues that this study implicates.

4.1 Methods used for data collection and data analysis

In order to perform a qualitative analysis of the content of a chat transcript and particularly the question types, the researcher used a method called content analysis, a method widely used in social research (Armann-Keown, Cooke & Matheson, 2015).

Content analysis is a nonreactive and unobtrusive technique. As the subjects are unaware they are being studied, it prevents errors linked to the subjects being aware of the context (Krippendorff, 2013). Consequently the researcher can process data that are “significant, meaningful, informative and even representational to others” (p 46). Krippendorff (2013) adds that this method is appropriate to study large bulk of unstructured data as it conserves the original design of the data unlike structured methods. Content analysis allows contrasting and comparing, explains Krippendorff (2013). As in any empirical study, the researcher has to decide what is analyzed and how the observation will proceed to create the data. Content analysis is based on a multiple observational occurrences that, taken together, support a hypothesis or in this study, a conclusion. The researcher uses coding units. Those refer to separate descriptions or coding for example. When the researcher has defined the coding units, their description is used as a reference to classify the text into the categories. This supports the process of comparison, analysis and it is used ultimately for inferences. The coding units can consist of several levels of inclusions leading to a more engaging content analysis as it is the case in this study when examining the second research question for example.

The researcher categorizes the data and performs an analysis of “the frequency of category occurrences” (Sharp, Rogers & Preece, 2007, p 382). It allows to make “replicable and valid inferences from text (or other meaningful matter) to the contexts of their use” (Krippendorff, 2013, p 24). Once the data are gathered, the researcher looks for recurring themes and reiterates the data coding of the material until the categories are saturated. The data classification based on previous works had to be adjusted to offer more precise information. The results of the grouping support the researcher when answering the study’s objectives. Quantifying the data, helps identify recurring patterns and critical incidents over the period studied (Sharp et al., 2007).

The role of iteration in qualitative data analysis is a reflexive process, explain Srivastava and Hopwood (2009). It aims at developing meaning-making connected to the process of analysis. Qualitative analysis is said to be inductive, which implies that the patterns, themes and categories emerge from the data but Srivastava and Hopwood (2009) explain that it is rarely the case

and that they are influenced by the researcher's goals and his/her interpretation connected to the theoretical framework, its "subjective perspective, ontological and epistemological positions and intuitive field understanding" (p 77). They conclude that the analysis procedure is deeply reflexive. Consequently the purpose of iteration is to bring insight and meaning leading to a more in-depth understanding.

4.2 Data collection

As indicated previously, there are no standardized guidelines to study virtual reference transactions so the researcher explored previous studies to craft a suitable set of categorization for this study. The schema was designed to provide a system of categorization allowing more in-depth information retrieval without the weight of multilevel categories.

4.2.1 Process

It proved to be challenging to find a university library offering digital services willing to participate. The researcher contacted several university libraries to get access to their transcripts, but obtaining the transcripts raised ethical issues as the libraries want to protect the patrons' privacy. Consequently they all retrieved themselves one by one. Fortunately, one university library accepted to participate under the agreement that the persons involved in the chat sessions would remain anonymous.

The sample used for the study consists of the entire record of the chat sessions from August 2015 to February 2016. It represents a total of 221 transcripts sessions. This time frame was deemed appropriate for the study goals as it reflects the most recent information requests initiated by patrons and a 6-month duration investigation was assessed as providing sufficient material to discover patterns of usage. The recorded material is printed and remains in chronological order throughout the research. For each recorded session, the chat transcripts are given an ID. The components are examined and labeled accordingly. All the transcripts were imported into an Excel spreadsheet and classified according to the systems developed during the coding process. The results are catalogued under the appropriate columns in a tabulated Excel spreadsheet. The appendices (see A, B and C) present a sampling of the three areas researched in this study.

4.2.1.1 Question classification

A content analysis of the 221 transaction transcripts was undertaken to identify the nature of the queries submitted to the chat reference service. A total of 11 categories of questions types were initially chosen. Nevertheless the resemblance between some categories such as *literature search* and *research*, *instructional* and *technical* led to large variations in the results.

1. *Bibliographic*: Content pertaining to auctorial information, publication, citations, copyrights
2. *Directional*: “Where” questions (shelves, room, personnel)
3. *Instructional*: “How to” questions, request information to improve personal competences
4. *Policy*: Services offered by the library or connected to the library
5. *Literature search*: The entire literary production about a subject, an author in connection with other relevant factors such as time, place, publication, peer-reviewed periodicals, etc.
6. *Ready reference*: Factual information, answered with one or two sentences
7. *Research*: All the literature related to one problem area (research articles, relevant books, statistics, theses, other document forms relevant for the research focus, etc.)
8. *Technical*: “How to “questions. Request information to improve digital skills such as accessing documents/websites, downloading programs/ software, ect.
9. *Holdings*: Do you own? Can you buy? (unknown and known items)
10. *Account information*: Loans, fee, extension
11. *Complaints*: Information/system deficiency

4.2.1.2 Answer completeness

The level of answer completeness refers to the level of session completeness of the reference staff’s answers to the patrons’ queries during the reference transaction. A content analysis of all the chat transcripts was conducted in order to code the level of answer completeness. The session completeness was established following those two categories: complete and incomplete.

Complete, when the librarian delivered links and or directional information appropriate for the query. *Incomplete* when the chat session did not lead to an answer to the information request. The level of completeness of the sessions is not based on the reference interview as some factual questions do not require such a lengthy process (Marsteller & Mizzy, 2003).

When the chat session was incomplete, several causes were lifted:

- *Time request*: the information provider needs more time to answer the question

- *Technical issues*: if the chat session ended prematurely due to techniques deficiencies
- *Evaporation*: whether the client initiated a chat and/or asked a question and then disappeared or the librarian never answer a received question
- *Other answer form*: the client requests an answer through another medium or was invited to leave his contact information for further contact regarding the request
- *Referral*: when the query could not be answered directly and the client was invited to contact another person or institution

4.2.1.3 Referral

The referred questions are the results of an incomplete chat session as the librarian does not possess the required competences to offer a complete answer and redirect the client towards a field expert. The patron is given the information specialist's contact information. Fuller and Dryden (2015, p 172) mention the most common sections where questions are conveyed:

- *Research librarian*: a subject specialist who can offer more in-depth information
- *IT office*: the library IT office gives technical advice and support the users
- *Other departments*: unrelated to the university library

4.2.2 Pilot study

Before the actual analysis a pilot study was performed on 10 of the 221 transcripts to test the method and refine it. The pilot session transcripts presented issues not anticipated: for examples, transcripts with no question from the user and containing only a formal greeting. Those transcripts were classified as *no question* category. Then some other transcripts including questions such as *holdings* were answered negatively. Consequently, they resulted in incomplete answer as the request is not complete but the person is not referred neither to other departments such as the public library for example. It happened that the client was referred to the librarian and invited to recontact the personnel through another communication medium so a category labelled *library department* was created under *referral*. This initial coding process was beneficial to understand some problems not anticipated when reading other research works.

While reading the transcripts, it was noticed that some chat sessions were divided among several transcripts. So interrupted chat sessions are counted as

one when the patron and the librarian continued the communication over several sessions regardless of the amount of time between the sessions. But if the request was answered and the librarian concluded the communication, any further contact from the patron was introduced as a new chat session.

An iterative coding of the empirical data was performed in order to refine the identified categories. After several iterative analyses performed on the chat sessions, the following categories appeared to reflect in-depth the content of the chat during that period.

4.2.3 Final coding for the chat transcripts

The transcripts of the chat sessions are classified as following.

4.2.3.1 Question classification

1. *Ebooks and online articles* focus on information and instruction about digital material. Those questions can be very specific addressing a particular item or general when a person wants to know if it is possible to download an ebook or article on their private computers.
2. *Various questions* are information and instruction requests not related to any of the other categories. This category covers general information requests about the library such as opening hours, telephone number, address, contact information, etc. This category includes also more specific questions such as grammar rules or incoming requests from university staff and other professionals. None of those questions are numerous enough or relatable to other main categories to create an own class. One inappropriate question with sexual connotations and one report about a difficult situation at the library premises appear in this category.
3. *Account related information* cover mainly questions about obtaining a library card, account confirmation or modification and printing possibilities. The information requests included in this category cover also printing credits, modifying account settings, etc.
4. *Book reservations and loans* include information and instruction requests about book reservations and loans. Those questions reflect the needs of the new students who have not received their student cards yet but need to borrow books. Many questions about the queuing system at the university library and when a book will be available appear in this category.
5. *Research related inquiries* gather questions focusing on research process and academic writing support such as how to write different

types of papers, how to search research articles, how to refer properly, collection and subjects oriented literature searches. This category is based on the merging of the previous categories: bibliographic, literature search and research.

6. *Interlibrary loans and article orders* cover questions related to those fields and usually how to proceed to obtain the material. Patrons ask usually questions about information and instruction concerning distance services offered to students.
7. *Book renewals and returns* questions request information and instructions about books renewals and returns due to issues when the users try to renew their loans but are not successful. Return questions lift problem due to location. It regularly happens that students have to return a book but they are not physically close to the library so they wonder how to proceed and need guidance. They might also face an immediate return and cannot return the book on time and they wonder about the direct consequences.
8. *Technical issues* concern questions where it is usually clearly stated that the user is facing a problem such as “error message” appearing or the patron cannot access some documents or programs. It also happens that the patron needs support to perform some computer related actions. This category merges technical support in relation to an identified dysfunction and most of the questions in the complaints category.
9. The category of *items requests and purchase suggestions* reflect the search for a particular item in the library catalogue and purchase suggestions related or not to the library catalogue content. Patrons often ask if the library owns particular items related to their courses as they would rather lend the book than buy it. Some questions about item location are included too. Very few questions about item purchase come through the chat service and they usually relate to the order itself when occurring.
10. *No question* category covers all the chat attempts that happen when no one was attending the chat. It includes also incoming compliments and chat tests. Those chat sessions can include initial contact from the patron, including sometimes a comment but no question.

4.2.3.2 Answer completeness

The answer completeness classification was modified: A session was deemed *complete* when the patron received directly the answer to the query. An *incomplete* session reflects all the other possibilities encountered. When the

chat session was incomplete, several causes were lifted but *time request* was removed as no librarian offered a delayed answer.

- *Technical issues*: if the chat session ended prematurely due to techniques deficiencies
- *Evaporation*: whenever the client initiated a chat and/or asked a question and then disappeared or the librarian never answered a received question or initial contact
- *Other answer form*: the client requests an answer through another medium or was invited to leave his contact information for further contact regarding the request
- *Referral*: when the query could not be answered directly and the client was invited to contact another person or institution

4.2.3.3 Referral

The referred question grouping was adjusted with another category being added:

- *Library department*: other personnel from the library
- *Research librarian*: a subject specialist who can offer more in-depth information
- *IT office*: the library IT office gives technical advice and support the users
- *Other departments*: unrelated to the university library

4.3 Ethical issues

It is actually easier to analyze a digital service compare to a traditional one as the recorded transcripts of the virtual sessions can be easily accessed and retrieved (Lankes et al., 2003). They suggest that those documents allow a deeper analysis compared to a recorded phone communication or a verbal interaction. Nevertheless accessing and using data without the informed consent of the participants leads to moral and ethical issues. A broad range of personal information is gathered in the process of the virtual transaction. Depending on the chat settings, several of the privacy elements can be recorded (Neuhaus, 2003). The interaction between the librarian and the user is the main component of the digital record. It is usually composed of “the initial question, a reference interview (if conducted), a response from the librarian, and any follow-up questions and response, [...] referrals to other library departments,

other libraries, or to individual librarians with appropriate knowledge or subject specialization” (Neuhaus, 2003, p 27)

The researcher, in the present study, performs an indirect observation using users’ activities tracking logs (see Sharp et al., 2007). Using unobtrusive method does not affect the performance of the users but it implies some ethical dilemma as the users are not aware that the data about their communication with the university library is being studied. However, obtaining the consent of the users could have led to a modified behavior or even a decrease in the use of the chat service, rendering false data about its actual use. As this form of chat format allows the user to remain anonymous if not invited directly by the reference librarian to give personal information, no personal information or data that could refer to a specific identifiable patron is cited by the researcher. Consequently, the personnel from the university library of Umeå and the supervisor of the thesis do not consider the use of the chat transcripts by the researcher, an infringement to the user’s privacy.

5. Empirical context

Digital reference services are used by a wide range of institutions such as museums and archives, administration and information experts, for example (Liu, 2007). The focus of this work is on libraries and more particularly on the academic libraries.

The chat reference service under study is based in Sweden. Only a few library chat services are available in Sweden in the whole country whereas it is a very common service in the United States of America. Although well-established directives are available to evaluate traditional services, as such measures were introduced “in the late 1960s and early 1970s” (Luo, 2008, p 71), the tools available for digital services are still limited due to its modernness. The virtual service under study started quite recently, in 2012 at Umeå University Library.

In 2006, the Umeå University Library became a member of the national service, Jourhavande Bibliotekarie, “on-call librarian”, a service offered by four universities since 2003. In 2005, the service was taken over by the National Library of Sweden in collaboration with twenty research libraries. In 2007, the service merged with the public chat library service and went under the same name: Fråga Biblioteket, “Ask the Library”, and stopped in 2011. It was replaced by a service called Bibblan Svarar, “the library answers”, the same year. In 2012, the Umeå University Library decided to open its own chat service as a result of a patron survey but the personnel had mixed feelings due to the past experience from the national service with low questions frequency and often local questions that could not be answered by a national service (Nilsson, personal communication, 2016).

It was decided from the start that the chat would not have fixed opening hours but it would be open when the personnel is online and available during opening hours. It was planned that as many employees as possible would participate but as time went by, around twenty persons mainly from the Medical and the Media libraries, the Customer Service and the Centre for Educational Development proved to be the most active in the chat. The chat was implemented at the Medical library and a small support group consisting of a person from the IT section, two persons from the University Library department and three persons from the Medical Library was created. Together they discuss problems related to the chat and lead chat group meetings. The chat has been recently moved to the Customer Service at the University Library (Nilsson, personal communication, 2016).

The chat reference service uses Pidgin (Erik, personal communication, 2016). It is an aggregated scaled-down free software for Instant Message (IM), explain Matesson et al. (2011), requiring no downloading for the user to access it and bringing together the various librarians from the different departments into one.

The personnel answering the chat service does not follow official documents but some common guidelines are implemented, explains Nilsson (personal communication, 2016):

- Give a welcoming impression
- Use grammatically correct sentences but in the tone of spoken language
- Prefer short sentences over long ones
- Avoid irony
- Answer the questions as you would on the phone
- Provide self-help

In 2015, according to Umeå universitet: Årsredovisning 2015, “Umeå University annual report 2015”, Umeå University had 29 852 registered students at undergraduate and master levels and 1 105 PhD students. 4 248 personnel were employed by Umeå University.

According to Universitets Kanslers Ämbete, “the Swedish Higher Education Authority”, in fall 2015, the netto number of registered students at Umeå University was 9 430 students under the age of 24, 7 296 students between 25 and 34 and 3 960 above 35 for a total of 20 686 registered students.

As reported by the National Library of Sweden, In 2015, Umeå University Library had 16 043 registered fulltime students and employed 102, 3 personnel, of which 62 were librarians and 15 were specialists, 7, 8 were library assistants and 17, 6 were student assistants and other personnel.

The chat service at Umeå University Library is open to anyone presenting an information request through the chat webpage. Nilsson (personal communication, 2016) explains that it is almost impossible to categorize the information seekers coming with requests to the chat service unless they explicitly give that piece of information. She adds that it might be possible to find some clues in the chat transcripts and she hypothesizes that most of the questions come from the students, and some from the researchers employed by the Umeå University and other libraries.

It appears that the Umeå University library archives the data from the chat service in order to create statistics and evaluate the service provided. The researcher was offered access to statistics concerning the whole active period of the studied virtual service and transcripts for the present study were delivered with the possibility to access any period. The chat service is evaluated regularly by the personnel in order to maintain its quality.

The lack of best practices and recognized guidelines has influenced the way the study was performed. The researcher relied heavily on previous research projects and literature to examine the questions under study and considered how other university libraries in Europe such as Linnaeus University Library in Sweden or the University Library at Toulouse Jean Jaurès in France perform a chat evaluation in order to ensure the outcome of the study. It is widely accepted that the chat reference transcripts are valuable resources for library administrators to study and for evaluation purposes but it raises the question of

privacy for both the users and the personnel involved (Johnson “Online Chat Reference” as cited in Meert & Given, 2009, p 73).

6. Results and Analysis

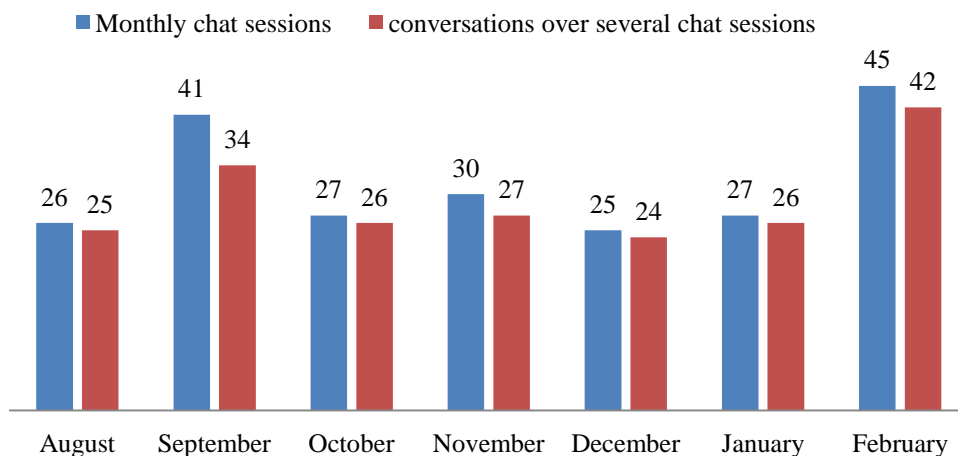
The results and the analysis are presented under the same chapter in order to facilitate the understanding of the data collected. The chapter is divided in three main areas following in order the three research questions.

This study analyzes 221 chat reference sessions incoming at Umeå University Library chat during the period from the 11th of August 2015 when the chat service opened after the summer holidays to 29th of February 2016. The chat was closed during Christmas holidays from the 22nd December to the 7th of January. As a consequence, it is noticeable that the chat was open only 21 days in August, 22 days in December and 25 days in January. When the chat sessions were reviewed, it appeared that many sessions were happening over several transcripts, consequently a total of 204 chat conversations are used for the analysis.

6.1 Classification of incoming information requests and chat sessions

6.1.1 Monthly chat sessions and monthly conversations

Table 1: Monthly Chat Sessions & Monthly Chat Conversations



The chat (see table 1) shows that most of the incoming chats are between 25 and 30 per month except in September and February when the students are the most active and send more information requests than during the rest of the year with numbers reaching above 40 chats during those months.

6.1.2 Monthly incoming information requests

Some of the transcripts had several different queries which could be different topics or follow up questions. It was calculated that 333 questions came through the chat during that period. The pattern of use of the chat spreads over the months as following:

Table 2: Monthly Incoming Information Requests

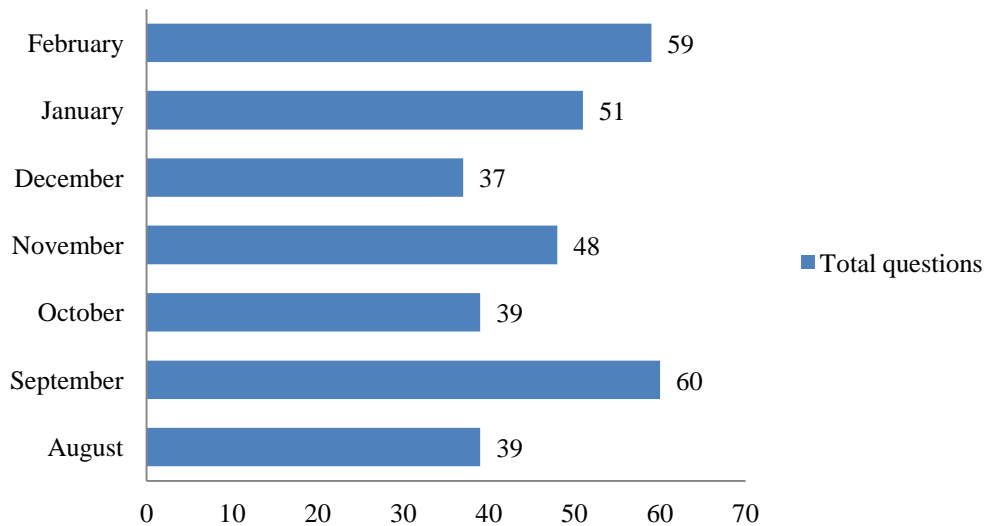


Table 2 shows that most questions come to the chat in September and in February with around 60 questions. Then January and November have around 50 questions and the lowest months are August, October and December with less than 40 questions.

When looking at the number of chats during the studied period (see table 1). It appears that the amount of chat answered reaches a maximal of 30 chats per months with two peaks over 40 sessions, in September and in February. Knowing that the fall term 2015¹ started the 31st of August, it comes with no surprise that the first month contains more questions than usual (see table 2). The spring term 2016² started the 18th of January and February is the month with the most chat sessions among all the recorded months.

6.1.3 Classification of incoming questions

Based on the classification scale elaborated by the researcher during the process of the analysis, it appeared that the information requests were divided as following:

The categories with the lowest results are the *no question* consisting of 3 % of the chat sessions and the *research inquiries* which represent 5, 7% of the information requests.

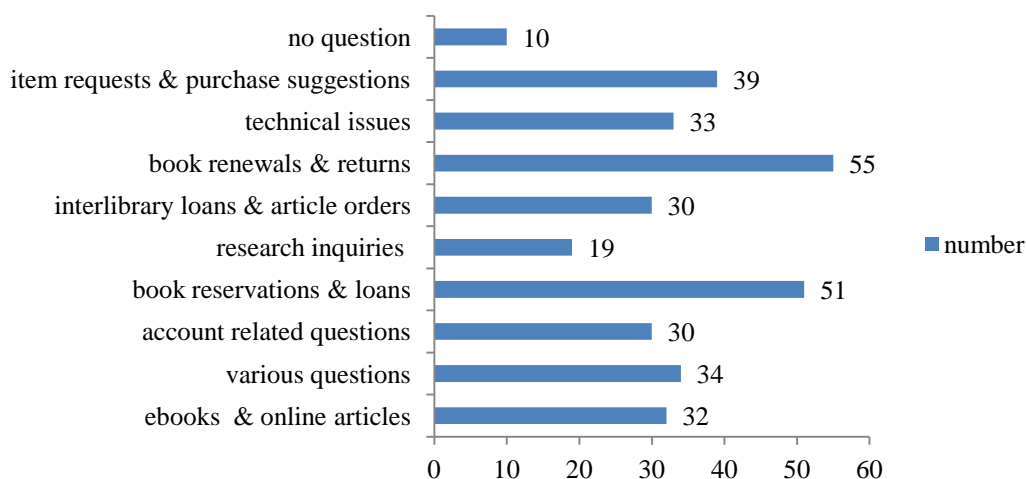
¹ <http://www.umu.se/utbildning/antagning/datum/>

² <http://www.umu.se/utbildning/antagning/datum/>

Then *the account related questions* represents 9 %. The *interlibrary loans and article orders* represent 9, 1%. The *ebooks and online articles* represent 9, 6 % of the incoming questions. *Technical issues* consist of 9, 9% of the concerns and 10, 2% for the *various questions*.

Item requests and purchase suggestions reflect 11, 7% of the total amount of questions. *Book reservations and loans* consist of 15, 3% of the requests, and the *book renewals and returns* questions cover 16, 5% of the problems lifted by the patrons.

Table .3: Classification of Incoming Information Requests



In table 3, it appears that the questions with the lowest amount of occurrences are either initial contacts with the chat service including no questions or that they require a reference interview (less than 6%) which is a lengthy process when communicating through the chat system. The most common questions (over 11%) are related to the loan rules. And average amount of questions (around 9 %) relate to online material, technical issues and account related information requests.

6.1.4 Types of information requests per month and over the study period

In Table 4, the most common questions in August are *book reservations and loans* and *account related questions*. In September, the same categories are the strongest with *book renewals and returns*.

In October and November *book renewals and returns* have a high number with a peak in December.

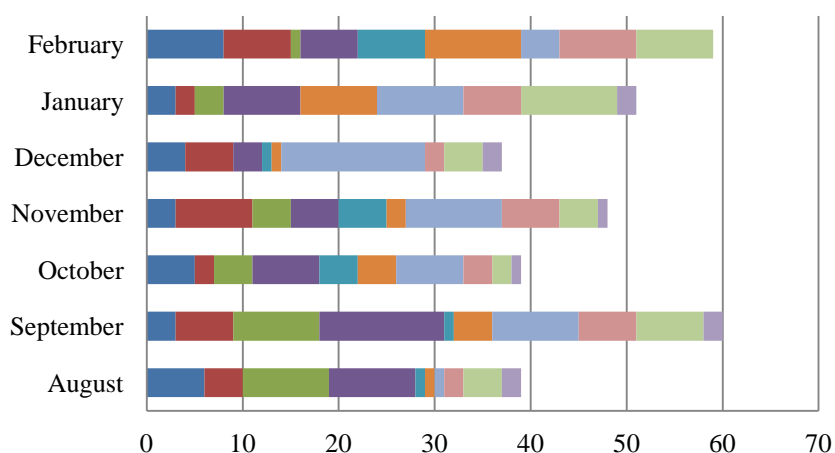
In January and February, *item requests and purchase suggestions* and *interlibrary loans* are very high.

In February, *ebooks and online articles* and *technical issues* have been requested most and *Research inquiries* have the highest requests compared to all the other months.

It is noticeable that the *no question* category occurs on a regular basis and remains very low. On the opposite, *technical issues* happen regularly but with 6 or more requests.

Book renewals and returns have a peak in September, December, January and February with 9 or more requests and a lesser number in August.

Table 4: Information Request Categories/Month



	August	September	October	November	December	January	February
ebooks & online articles	6	3	5	3	4	3	8
various questions	4	6	2	8	5	2	7
account related questions	9	9	4	4	0	3	1
book reservations & loans	9	13	7	5	3	8	6
research inquiries	1	1	4	5	1	0	7
Interlibrary loans & article orders	1	4	4	2	1	8	10
book renewals & returns	1	9	7	10	15	9	4
technical issues	2	6	3	6	2	6	8
item requests & purchase suggestions	4	7	2	4	4	10	8
no question	2	2	1	1	2	2	0

In table 4, *Account related questions* occur almost exclusively in August and September which could be related to the beginning of the term. *Book reservations and loans* are also very strong during those two months which can be linked to the need to become familiar with the process of lending books. The book renewing and returning process spreads from September to January and might be linked to the library circulation policy stating that a text book non-returned on time shall lead to the freezing of the student account on the very same day until the book is returned and for six weeks forwards. *Interlibrary loans and article orders* and *item requests and purchase suggestions* are strongest in January-February probably due to the beginning of the essay writing period.

6.2 Answer completeness

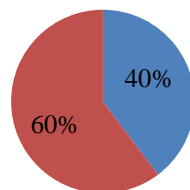
6.2.1 Incomplete and complete sessions and questions

The results show that 81 chat conversations were not complete and 123 were complete. But at an information request level, out of the 333 incoming questions, 81 are not being answered during the chat session.

Table 5: Incomplete & Complete Chat Sessions and Incomplete & Complete Questions

Incomplete & Complete Sessions

■ Incomplete session ■ Complete sessions



Incomplete & Complete Questions

■ Incomplete questions ■ Complete questions

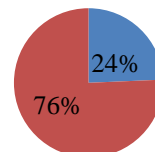


Table 5 shows that the complete sessions represents 60% of the sessions, which shows that more sessions are complete than incomplete; and at a question level, the proportion of complete questions is higher and reach almost three quarter of the questions being successfully answered compared to one quarter being incomplete.

6.2.2 Monthly chat session complete and incomplete distribution

In August and February, around half the sessions are either complete or incomplete. In September and October, November and January around two third of the sessions are completed. December is the month with the most complete sessions with almost three fourth of successful sessions.

Table 6: Monthly Chat Distribution: Complete & Incomplete

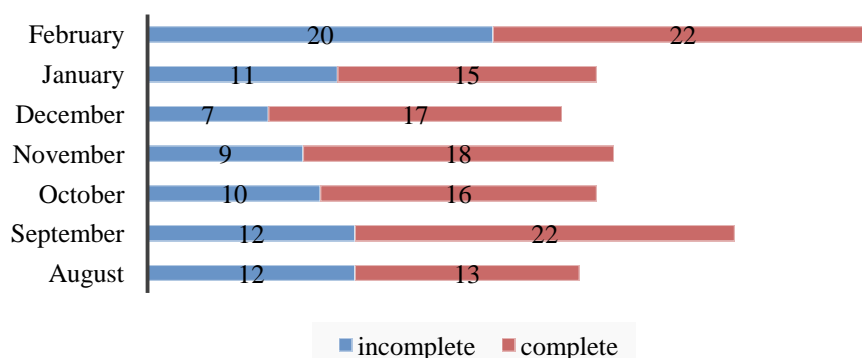


Table 6 shows the evolution of the monthly chat sessions throughout the period studied. It is interesting to note that the period of the chat studied started with half the sessions being successfully answered in August, and end in February with the same results. August and February have the highest amount of incomplete sessions. This result is remarkable since the overall successfully answered rate significantly increases through the period studied, with a peak of completeness in December when the chat sessions were the less numerous, until January-February when it drops significantly.

6.2.3 Incomplete question per question category

Almost half of the *various questions* and the *technical issues, research inquiries* and *no questions* are not answered. When it comes to *ebooks and online articles* and *interlibrary loans and article orders, item requests and purchase suggestions*, one fourth of the questions are not complete. The most successfully answered questions are *account related questions, book reservations and loans*, and *book renewals and returns*.

Table 7: Incomplete & Complete Questions/ Question Category

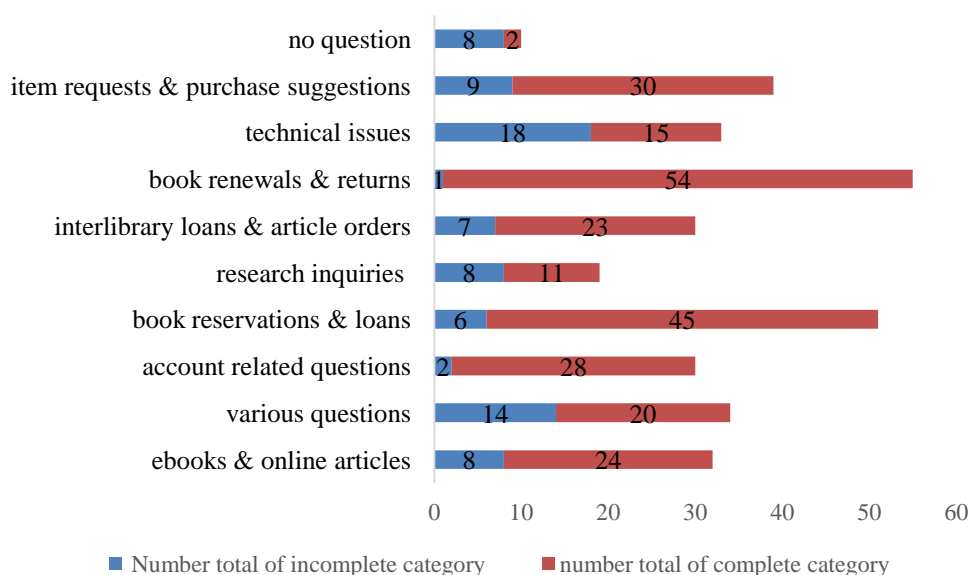


Table 7 shows that the most successfully answered questions are account and circulation related questions such as loan and return policies. Those requests are policy-related questions which are recurring and demand general knowledge of the library system. But the hardest questions to answer on the chat service appear to be related to questions outside the general knowledge about the library services. Questions requiring more specific knowledge such as questions related to online services are answered less completely and the questions requiring very specific knowledge are more likely to be incomplete.

6.2.4 Monthly incomplete chat conversation distribution per question category

With 3 occurrences, *various questions* is the category with most incomplete endings in August.

In September and January, it is similar with *technical issues* and in October, it is *research inquiries* that top the incomplete categories.

In November, it is both *various questions* and *technical issues*.

In February, *ebooks and online articles*, *research inquiries*, *interlibrary loans and article orders* and *technical issues* are the categories with most incomplete sessions.

Table 8: Monthly Incomplete Chat Conversation/ Question Category

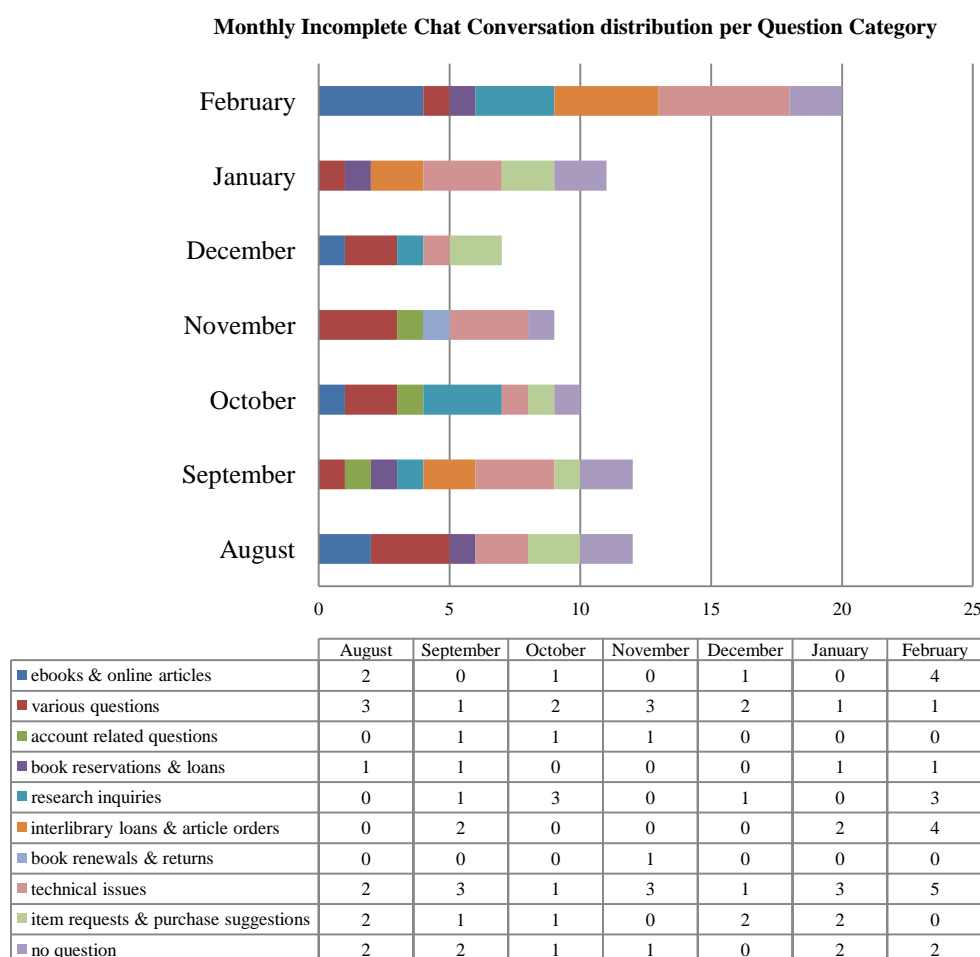


Table 8 shows that the amount of information requests per months affect the success of the answer completeness per month. For example, August, September and February have the highest level of incomplete questions. Those incomplete questions are usually related to the level of knowledge required to be able to answer those questions completely.

6.2.5 Causes for incomplete chat sessions

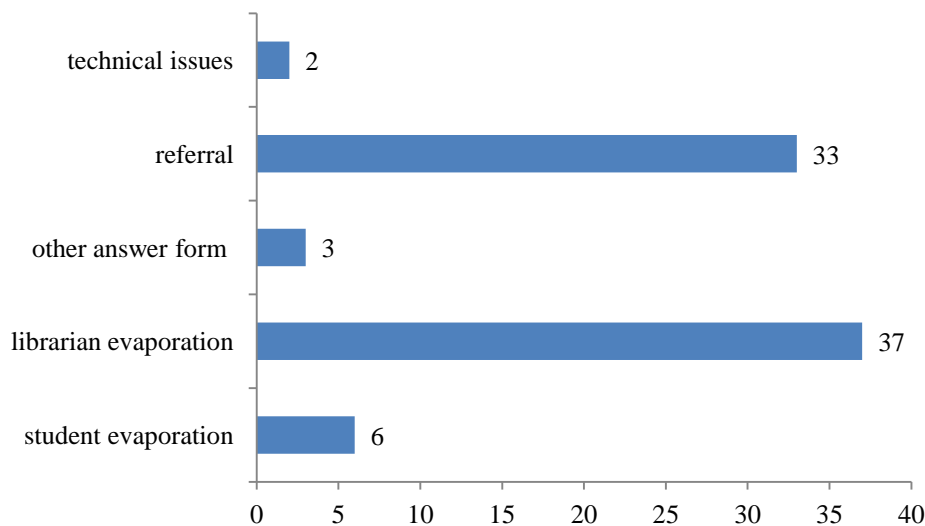
When looking closer at the 81 incomplete chat sessions, it appears the most common causes are either librarian evaporation or referral.

In seven percent of the incomplete situations, the student disappeared from the chat and in forty five percent of the sessions the librarian vanished.

In four percent of the incomplete sessions the user was offered or asked to be recontacted through other forms.

The users were referred in more than forty percent of occasions and two percent of the sessions ended prematurely due to technical issue.

TABLE 9: Causes of Incomplete Chat Sessions



It is remarkable that two main causes of answer incompleteness in table 9 are the librarian not answering the chat and referral. One would expect that the technical issues would be a more common problem but it seems that the software used is performing very well.

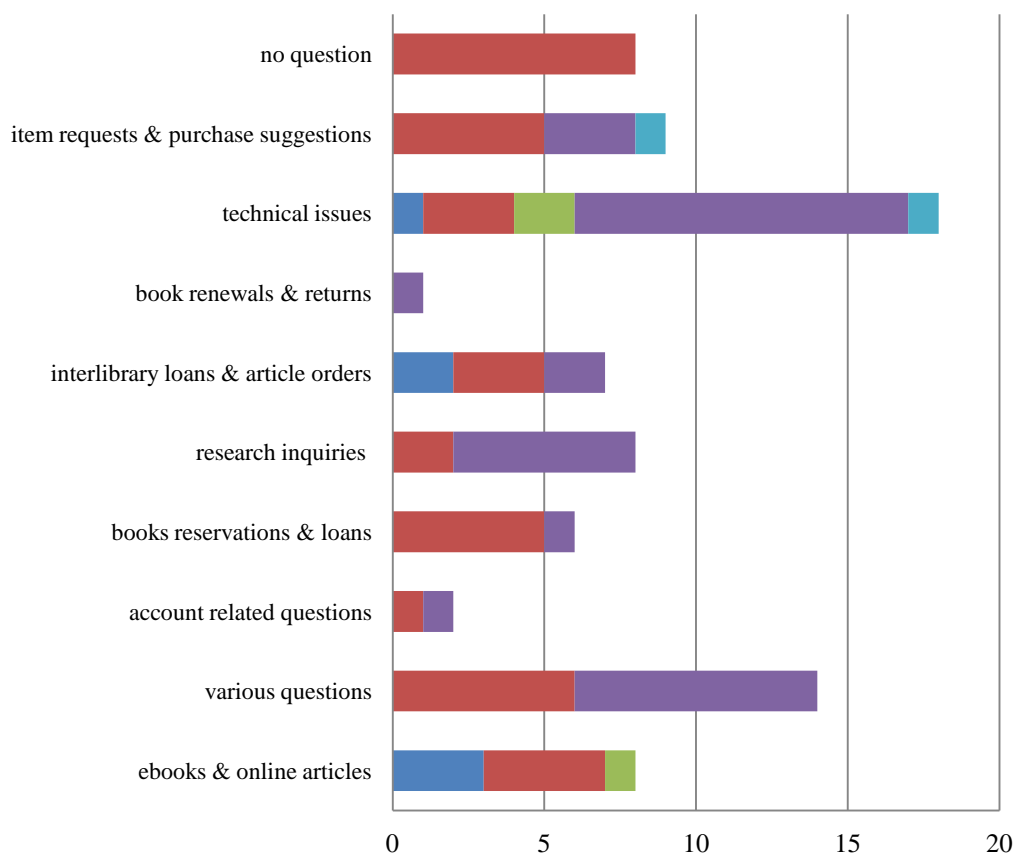
6.2.6 Causes of incomplete chat sessions per question category

The dominant cause of incomplete chat sessions is evaporation from students and librarians when it comes to *ebooks and online articles*.

Referral is the main cause of incompleteness for *various questions, research inquiries and technical issues*.

The incomplete sessions are due mainly by librarian evaporation in *item requests and purchase suggestions, no question and book reservations and loans*.

Table 10: Cause of Incomplete Chat Sessions/ Question Category



	ebooks & online articles	various questions	account related questions	books reservations & loans	research inquiries	interlibrary loans & article orders	book renewals & returns	technical issues	item requests & purchase suggestions	no question
student evaporation	3	0	0	0	0	2	0	1	0	0
librarian evaporation	4	6	1	5	2	3	0	3	5	8
other answer form	1	0	0	0	0	0	0	2	0	0
referral	0	8	1	1	6	2	1	11	3	0
technical issue	0	0	0	0	0	0	0	1	1	0

Table 10 shows clearly that the questions that require the most knowledge are usually referred. The student evaporation seems to occur when the patrons require help to access online service such as *ebooks and online articles*, *interlibrary loans and article orders*.

6.3 Referrals

6.3.1 Total amount of referrals

The referrals represent 33 sessions of the total of 204 chat sessions

Table 11: Referrals / Total Number of Chat Sessions

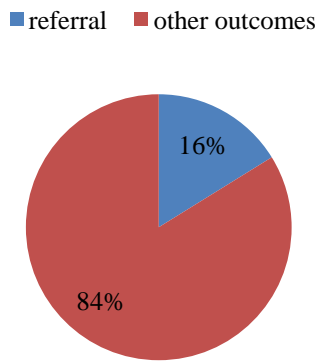


Table 11 shows that the referrals represent less than 20% of the chat sessions.

6.3.2 Referrals destination over the study period

The referrals concern almost 41 percent of the total of the incomplete sessions. From the 33 sessions, three are referred to a research librarian and four to the IT office, or to other departments. And twenty-two to another library department

Table 12: Referrals Destinations

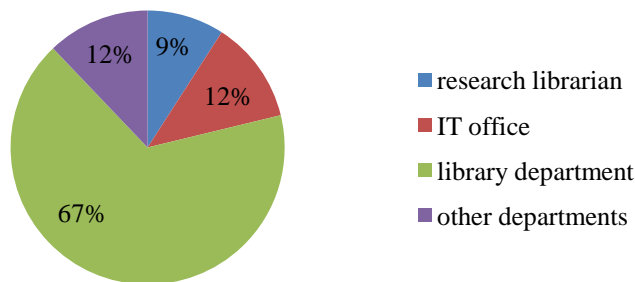


Table 12 shows that almost 70% of the referred questions are sent to the library department and the probability to refer a question to the IT department or another department is equally low. The lowest referral destination is a research librarian.

6.3.3 Referral destination per month

It appears that the months with the highest amount of referrals are November, January and February and the month with the lowest amount of referrals is December.

Table 13: Referral Destination/ Month

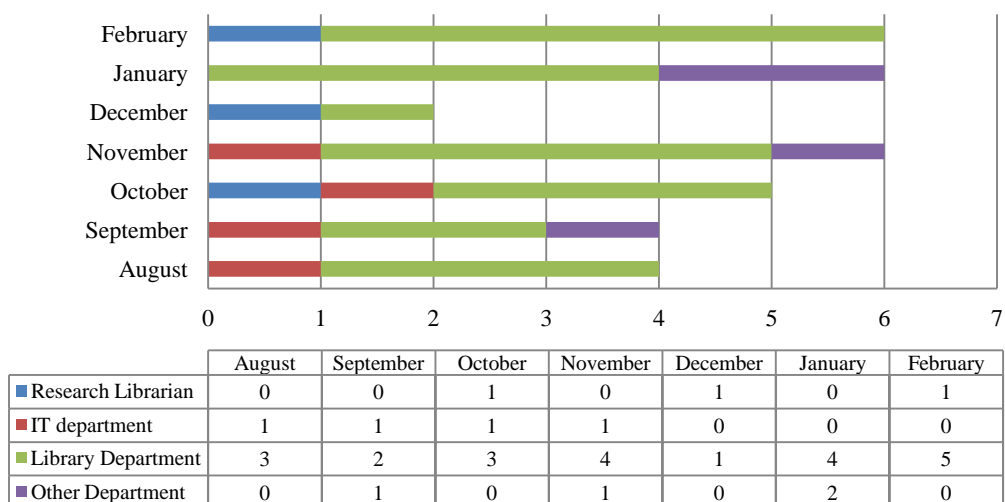


Table 13 shows that the amount of referrals can be connected to the amount of incoming questions, as January and February are months with high amount of questions requiring the most extended competences.

6.3.4 Questions category and referrals

The most common referred questions are *technical issues* (11 occurrences), *various questions* (8 occurrences), and *research inquiries* (6 occurrences). But *no ebooks and online articles* are forwarded.

Table 14: Referrals/ Question Category

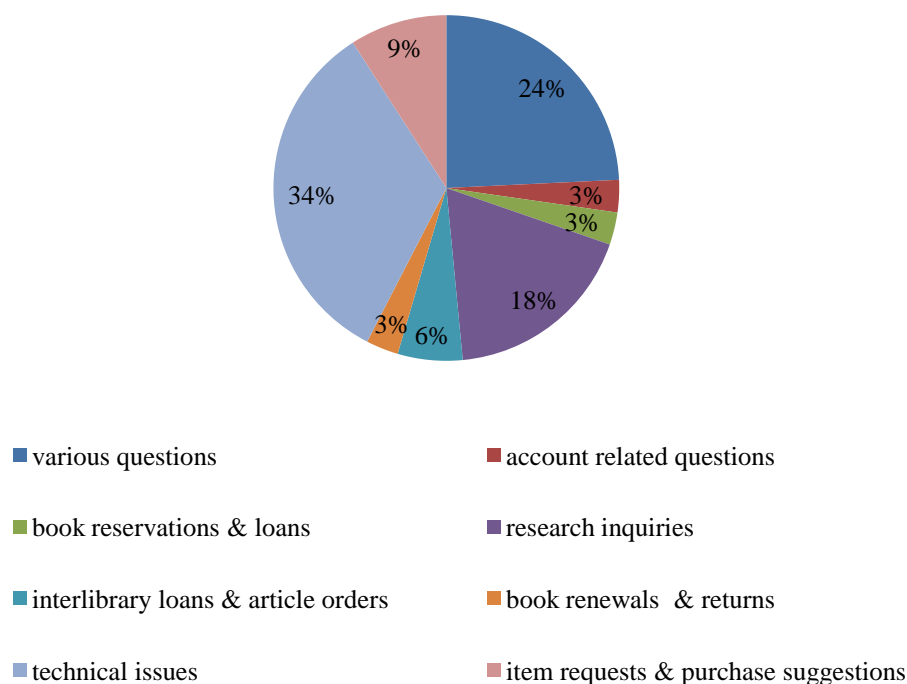


Table 14 shows that the research questions have a low level of referral and only 3 questions were referred to a research librarian and two to another library service. One fourth of the *various questions* are referred which reflect the need to include more varied competences among the personnel attending the chat. Despite having an IT personnel attending the chat service from the support group, the high amount of technical questions, one third of all the referrals, denotes a clear IT competence need among the librarians attending the chat service.

6.3.5 Referral destination per question category

The data presented show that the library department is the main destination for the incomplete questions.

Table 15: Referral Destination / Question Category

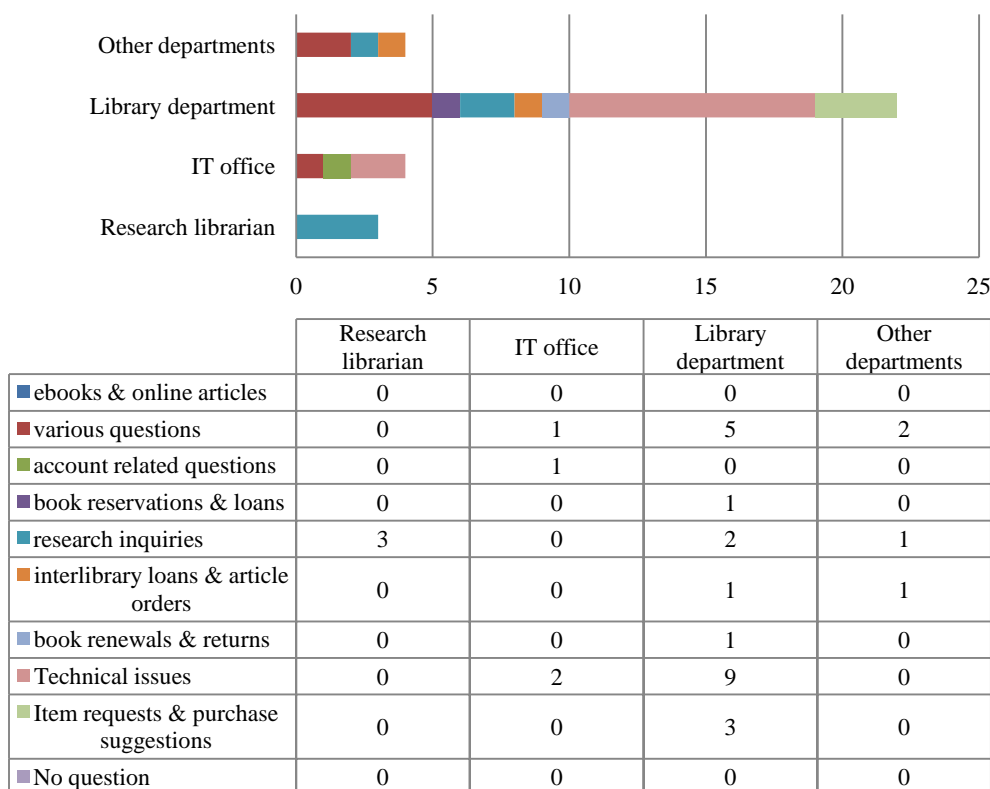


Table 15 shows that most of the technical questions are not referred to the IT office as one would expect but to other library departments (9 out of 11).

7. Discussion

This study aims at extending the knowledge about Umeå University Library's digital reference services and the phenomenon of such a service in an academic setting. The design aims at investigating the information requests and the outcomes of the chat sessions, focusing notably on the referrals in order to understand the trends and the discrepancies in the service usage and by so exposing the status of the chat service at the Umeå University Library.

7.1 Classification of incoming information requests and chat sessions

The first point investigated by the researcher focuses on the classification of the incoming queries and the distribution of the chat sessions in the interest of finding patterns of usage.

7.1.1 Monthly chat sessions and monthly chat conversations

The chat usage follows the academic calendar for both fall and spring terms with a peak in September and in February (see table 2) which is similar to Morais and Sampson (2010) and a lower period during the rest of the fall term as noticed also by De Groote et al. (2005) and Goda and Bishop (2008, p 313). Despite the circumstantial chat attendance from the personnel at the Umeå University Library, the student community chooses to use that information channel and the usage pattern follows the academic year. This suggests that the chat service is considered a fitting communication channel with the university library.

7.1.1.1 Chat sessions distribution

Despite the non-scheduled attendance of the chat service by the personnel the chat service follows a foreseeable pattern for an information service with a peak at the beginning of each term.

The question submission process favor the anonymity of the user as any person can enter in contact with the chat service and submit a question without having to complete a form including any personal information. Some librarians even introduce themselves when starting a conversation to create a welcoming atmosphere (Nilsson, personal communication, 2016). This behavior reflects an attempt to "personalize the service" (Neuhaus, 2003, p 28). It is a way to create a relationship, as the verbal and the visual cues are not recognizable in the chat setting, a familiar name can make the difference.

The variety of the incoming questions ranging between 30 and 55 occurrences per question category, except for research question which is under 20

instances, reflects a balanced distribution of the incoming information requests (see table 3). This confirms that the users do not feel limited by this medium and ask a wide range of questions. As a result, the library should provide the tools to enable the agents to engage with the same range of questions (Matteson et al., 2011).

Nevertheless Wikoff (2008) raises the question of adequacy when using the chat service for research questions, a topic already lifted in the beginning of the 21st century by librarians. The results of the present study clearly show the sparsity of such questions in the context of the chat service. Kwon (2007) suggests that the chat reference service is less effective for research questions due to the limitations connected to this form of service linked to the difficulties to perform a complete reference interview and perceive the audio-visual cues. Kwon (2007) emphasises the adoption of enhancing features in the context of chat reference service such as VoIP to enable a more effective proceeding of more complex questions.

Kwon (2007) explains that questions coming at the reference service are either directional or reference questions. Directional information related to the library resources and services requiring low expertise from the information providers as opposed to most advanced questions. It is argued that the chat service is most appropriate for directional inquiries due to the service characteristics. And those statements are supported by the present study where most of the questions are related to the use of the library resources and services and less than 6% of the queries are related to research (see table 3). The dominant categories are circulation, holdings and account related questions (see table 3) which is similar to Kwon (2007, p 85) with more than 50% of the sessions.

7.1.2 Classification of incoming questions

7.1.2.1 Question submission

Account activation and loans policy are recurring questions despite a highly marketed “first time at the library?³” link on the library homepage is in place at the beginning of the term to support the new students in the process of familiarization with the library but the personnel remains an assistance and it is presented as an alternative to human and computer-mediated interactions for the more independent patrons. Furthermore three patrons requested to be contacted via email when presenting a question on the chat platform (see table 9). This idea is supported by Wikoff (2008) who suggests that the librarians should abide to the wide range of possibilities offered by the internet. “Services and programs must become more responsive, more flexible, more convenient, and more personalized to users, taking into consideration many different learning styles, attitudes, beliefs systems, and orientations to technology” (Fritch & Mandernack, 2001, p 300). Radford and Connaway (2013) explain that albeit the possibilities to find all kind of information on browsers and search engines, searchers do not have the same level of digital literacy or the

³<http://www.ub.umu.se/>

interest to navigate the web. Additionally, a positive encounter through the virtual service including a correct answer in timely manner can affect the choice of service.

7.1.2.2 Circulation policy and account related questions

Morais and Sampson (2010) explain that in September, the new students discover the library policy and resources and they need to obtain a library card which is reflected in the high number of requests related to account questions and book reservations and loans (see table 4). As noticed, *account related questions* represent only 9% of the questions but those questions are recurrent mainly in August and September. This result is quite similar to Goda and Bishop (2008) with policy/card category peaking at the beginning of the semester which is deemed a normal behavior for new and returning students.

When analyzing the information requests (see table 3), it is noticeable that the highest amount of questions refers to the circulation policy (almost 32%) including *book renewals and returns* and *book reservations and loans*. This high percentage of circulation-related question is not uncommon and in Kwon's study (2007), almost half of the questions were circulation inquires and Arendt and Graves (2011) report the strongest category of questions with 38% (p 195) and Marsteller and Mizzy (2003, p 156) 34% of directional, policy and procedure question which is also the most common incoming question category. Radford and Connaway (2013, p 7) notice an increase of procedural questions (library policy and procedures) which rise from 18% in 2004 to 31% in 2006 and Arnold and Kaske (2005, p 182) who studied a chat service in an academic library, counted 41% of policy or procedural related questions.

The overwhelming number of questions about circulation policy, holdings and accounts at the beginning of the fall term (see table 4) suggests that the information strategy concerning those particular types of information sources should be evaluated "in terms of information goals and efficacy" (Goda & Bishop, 2008, p 309) to become more user friendly (De Groote et al., 2005).

Goda and Bishop (2008) suggest in their study that a staff model based on the triage of the incoming questions leading to one information provider focusing on policy and membership activation especially at the beginning of the terms would be beneficial. Goda and Bishop (2008) and Meert and Given (2009) make the similar conclusions about questions related to policy. Those questions are recurring and demand general knowledge of the library. They suggest a reevaluation of the efficacy of the library communication strategies and eventually a question triage to improve the efficiency of those information requests. But a triage of the queries seems time craving for the staff attending the chat and would probably require an adjustment of the chat system which in the actual context of voluntary attendance does not appear very effective.

Kwon (2006) suggests in her study of a collaborative chat service to create a Frequently Asked Question (FAQ) database in order to facilitate information retrieval for the patrons. Pomerantz (2005) explains that the tendency to use the chat service instead of reading the information on the website might reflect the

habits of patrons who adopted the chat communication as a way of communication for private and service purpose (Pomerantz, 2005) and find it more convenient than any other ways of obtaining information.

7.1.2.3 Holdings

New students seem to have difficulties navigating the catalogue. As De Groot et al. (2005) stated: “this group of users also required the most guidance in selecting databases and pathways for finding information” (p 449). Holdings questions, including both, *item requests and purchase suggestions*, and *ebooks and online articles*, account for more than 21% (see table 3) which is close to the results from Arnold and Kaske (2005) with specific search at 20% and holdings at 16%. De Groot et al. (2005, p 446) counted 25, 6% of question about the library collection and Marsteller and Mizzy (2003, p 156) 28% of questions about holdings. Greenberg and Bar-Ilan (2015, p 143) recorded a considerable amount of short questions (42%) concerning “item by its bibliographic details or for circulation information”.

Greenberg and Bar-Ilan (2015) explain that the patrons choose to use the online chat service for support to access online material due to its nature. This can be one of the reasons why this means of communication is used for IT support when the patrons face a technical issue preventing them from accessing online material. The nature of the question and the goal seems to influence the way the users retrieve information. For example databases and online resources can be accessed instantaneously with the right process and information so users are more likely to use the chat service for support.

7.1.2.4 Research paper and examination period

The research paper period in January-February strikes as a time when patrons request more support from the librarians when accessing online literature which could hide a more in-depth research need from the user but it is difficult to assess the need as few research questions comes to the chat services and as Kwon (2007) states, research questions appear to be less effective in the virtual context of the chat service.

Arendt and Graves (2011, p 197) had also a result of 24% and presented a significant increase of articles questions in the February month in their study which is quite similar to the present study (see table 4). The high amount of holding requests raises the question whether the item requests are singular or conceal a research question in the January-February months (see table 4). Arendt and Graves (2011) suggest that the augmentation of the holding requests throughout the months under study can either suggest a weakness in the catalogue interface or be connected to a knowledge deficit from the patrons.

Morais and Sampson (2010) explain that in February, the examination preparation and research paper seminar period peaks which translate into an increase of *interlibrary loans and article orders* and *ebooks and online articles*

and consequently more technical questions. *Interlibrary loans and article orders* in this present study represents 9, 1% of the incoming questions (see table 3), which is lower than the 16, 1% from Arendt and Graves (2011, p 197) but it was noticed that in both studies the number of interlibrary loans increased throughout the study period and the number of interlibrary loans are mainly occurring in January and February when the research and examination period starts (see table 4).

7.2 Answer completeness

The second point examined by the researcher concentrates on the quality of the answers from the librarian attending the chat service. This allows understanding what questions are most effectively answered through the chat service and what specific competences should be added to the staff responding to the information requests.

7.2.1 Incomplete and complete chat sessions and questions

40% of the chat sessions are not answered successfully and almost a fourth of the incoming questions do not receive a complete answer (see table 5). Those numbers are difficult to reflect on as many previous studies combine many categories of level of completeness to assess the level of efficacy of the virtual system under study. For example, Ward (2004, p 52) announced that the completion answer rate of virtual chat service was 79% when combining both complete and mostly complete chat sessions and Maximiek et al. (2010 p 366) count 84% of correct answers and Fuller and Dryden (2015, p 174) 93%.

Apparently the completion rate varies from studies to studies due to the selection factors used. Meert and Given (2009, p 79) had the local staff answer the answer completely in 89% of the time. The 11% of not-answered directly questions in Meert and Given (2009, p 81) are usually linked to the lack of expertise of the information provider (48%) or technical difficulties (26%). Those conclusions are quite similar to Kibbee et al. (2002) who state that “the failure to completely answer a question occurred because the staff member was unaware of the specific resources or services” (p 134). Van Houlson et al. (2007, p 26) have a 57% rate of answered questions and Kwon (2007, p 85) a 56, 4% and Arnold and Kaske (2005, p 188) declare a 92% of correct answer including deferred, referred and lost questions.

But this present study does not include referrals, technical issues and other answer form as well as librarian and student evaporations in the complete questions and chat sessions. Any situation that did not include a prompt complete answer from the librarian was dismissed as a complete answer as the patron had to move further in the search process to obtain the answer to his/her information request. When applying the “55 percent Rule” from Hernon and McClure (1986), it is satisfying to acknowledge that the present study is

achieving better results with 60% chat session completion rate and 76% of completely answered question (see table 5).

7.2.2 Incomplete questions per question category

It is noticeable that the nature of the requests influences also the overall success of the chat sessions. For example, September and February are the months with the most information requests but the completion rate is substantially higher in September with two third compare to half of the sessions in February (see table 6). Those months differ greatly in their characteristics: September is the beginning of the academic year so the questions are more circulation and account-related whereas in February the questions are predominately oriented towards research paper writing and accessing online and interlibrary material (see table 4).

The most difficult questions to answer directly on the chat seem to be outside the common knowledge about the library services. Queries such as *various questions, research questions* and *technical issues* have an excessively low rate of completion (see table 7). The technical issues queries would probably be more appropriately sent directly to the IT department or enhancing the competences of the personnel attending the chat would certainly affect positively the information providers' performance as Morais and Sampson (2010) suggest. This suggestion is supported by the results concerning the level of completeness regarding more specific services accessible from the university library such as digital material and interlibrary material (see table 6).

7.2.3 Technical problems

As lifted by a librarian from the Umeå University Library (Jakob, personal communication, 2016), technical issues are quite rare, only two occurrences were registered as such in the present study (see table 9). This extremely low number reflects a very effective chat service system in that matter. Those results are better than Arnold and Kaske (2005, p182) with twelve questions out of 419 and Van Houlson et al. (2007, p 26) who recorded 41% of the 641 chat sessions leading to technical problems and Meert and Given (2009, p 81) with 26% of the local staff being able to answer questions in real time due to technical issues. Kwon (2007) notices in her study that 9.8% of the transactions resulted in a "problematic ending" when the session ended before the patron received an answer due do "disconnections, delayed answers, or uncertain reasons" (p 78). Those results are quite similar to Van Houlson et al. (2007, p 33) study with transactions with technical problems including also 58 abandoned sessions which represent 9% of the total transactions. Technical problems seem to be a recurrent issue in virtual reference services, which should be taken into consideration when evaluating the service quality. Pomerantz, (2005) in his model, underlines the recurrent issue of technical failures leading to the premature disconnection of either the librarian or the patrons.

7.2.4 Student and librarian evaporation

It is noticeable that 43 abandoned sessions or 21% of the total transactions (see table 9) in the present study is due to evaporation of the student or the librarian which is extremely high compared to Van Houlson et al. (2007) and Kwon (2007) but still much lower than Marsteller and Mizzy (2003) with 32% of transactions with technical issues where no question is asked (p 156). The student evaporation happens when the student connect to the service, ask a question, but exit the chat while the operator is engaged searching for answers. The author considers similar causes lifted by (Neuhaus & Marsteller, 2002) leading to aborted communications such as a change of mind and the direct consequent behavior of leaving promptly the chat without further ado or other possibilities suggested by Wikoff (2008) such as being bored or distracted in the physical environment.

7.2.4.1 Student evaporation

Students disappeared in a few instances during the chat sessions which can be related to the context of the chat (see table 9). As the agent acknowledges the patron but do not see the person, explain Greenberg and Bar-Ilan (2015), the interpersonal reaction can be difficult to predict. Neuhaus and Masteller (2002) and Wikoff (2008) lifted other causes such as a distraction in the physical world. This behavior lifts up the question of Instant Messaging Etiquette as such a behavior would not happen in the context of the information desk for example. A more appropriate behavior is reflected in the few patrons who asked to be contacted through another answer as they could not converse with the agent at the present time but were in need to obtain an answer about a particular topic. When looking closer at the questions when the patrons disappeared, it was noticed that *ebooks and online articles* and *interlibrary loans and article orders* are the main categories (see table 10). Those two sections are known to be recurrent during the research paper period which might explain the lack of etiquette linked to a stressful time for the users.

7.2.4.2 Expert selection and librarian location

When asking the Umeå University Library chat personnel about the issue of librarian evaporation (see table 9), it was asserted that the technical problems were very rare but other possible explanations are lifted: the librarian attending the chat service expects someone else to answer the incoming question or the person is not attending the chat but is still logged in on the virtual service (Jakob, personal communication, 2016). Those situations reflect a gap of communication between the personnel attending the service as well as a human behavior that need to be addressed. It seems that two situations are happening in the process of the expert selection: in the first one, the agent makes an active choice to disregard a question which causes should be addressed and secondly the prompt departure of agents from the chat due to other duties should be easily manageable for the librarians in order to support their work load. These two sorts of incidents affect negatively the efficacy of the chat and could lead to a decrease of its use by patrons due to the deceiving perception of its

effectiveness. An adequate measure to correct the problem of librarian evaporation would be to enhance the technical functions of the chat in order to support the intern communication and reduce the occurrences of the reference personnel disappearing on users.

The outcome of the chat sessions remains within the range of other studies results when using common criteria. Nonetheless training the staff in performing a virtual reference interview and offering them the possibilities to retain knowledge about more specific services offered by the library through competence development programs would highly support the sustainability of the chat service.

7.3 Referral

The last point investigated focuses on the referrals and the extent of the questions referred to other library department in order to reflect on the adequacy of the staff attending the virtual service.

7.3.1 Total amount of referred questions

The reference transaction is a process when the librarian and the patron have a dialog in order to understand the information request from the user so the agent can direct this person to the appropriate information source. This negotiation activity in the virtual context of the chat has similitude with both the information desk and the phone conversation settings. Still the outcome of such an encounter depends greatly on the field of expertise of the agent and on the amount of requests. It was noticed a conspicuous relation between those two factors throughout the study and September, December and February are appropriate representations of that statement (see table 4, 6 & 8).

According to the results of this study, approximately 16% of the questions were answered with referrals (see table 11). Grenberg and Bar-Ilan (2015, p 143) and Van Houlson et al. (2007, p 26) have respectively 37% and 38% of referral of the chat sessions, and Arendt and Graves (2011, p 198) and Kwon (2007, p 80) deduce that 29% of the sessions ended in referrals or transfer which is in the study from Kwon (2007) linked to the collaborative chat environment. Neuhaus and Marsteller's (2002, p 36) study resulted with 28% of referral. The results from this study are close to Armann-Kewon et al. (2015, p 663) with 18% referrals to another library department and Arnold and Kaske's (2005) results with almost 13% referrals (p 182). De Groote et al. (2005) transferred and referred less than 10% of the incoming questions. Kwon (2007, p 84) study of a collaborative chat service shows that almost 45% of the questions about local services were referred compared to almost 10% of the non-local questions. The study with the lowest referral is Ward (2004, p 50) with only 3% based on predetermined question. When focusing on single library system where the referral level is usually under 20%, the present observation appears unexcessive but not optimal.

7.3.2 Referred question categories

Almost 40% of the questions referred in Arendt and Graves (2011, p 199) are policy and procedure questions, 24% are research questions and 20% holdings questions. 29% of the referrals go to the circulation department and the results from Armann-Keown et al. (2015) points also towards the circulation desk.

Questions about circulation and account tend to be more completely answered than technical issues, various questions and research questions which involve more specific knowledge (see table 7). The amount of referrals does not appear to be linked to the number of incoming questions as no peak of referrals appears in September for example, but more likely to the class of questions and the competences they required as suggested by Matteson et al. (2011), who explain that referrals usually follow an expected paradigm (see table 14).

One third of all the referrals are technical issues questions, one quarter are various questions and one fifth research questions (see table 12). As stated earlier, the complete answer rate of technical and research questions can be improved with adapted management decisions. However various questions are unpredictable in their content and by so being more complex to anticipate.

7.3.3 Referral destination

Almost 90% of the referred questions are sent internally to the IT office, research librarian and library department (see table 13). This result implies that the chat service is used as a substitute to the library information desk and it is not perceived as an alternative to the university information desk. It is noticeable notwithstanding the original queries that most of the questions are sent to another library department and are as likely to be referred to the IT office as to another department (see table 15). The questions referred to the library department cover a broad range of circulation and holdings issues: from item requests and purchase suggestions to technical issues. This means that the chat service require a broader range of competences to contribute to its effectiveness.

The number of referrals reflects the need to enhance the knowledge of the staff attending the chat service or to include personnel with the competence needed. It is an issue that needs to be addressed at the management level to improve the efficacy of the chat service. To strengthen the chat service, the management has several alternatives: one approach could be to include more personnel attending the service with the possibility to schedule the chat attendance among the library personnel or to offer the possibility for the chat agent to broaden their competences through a skills development program.

8. Conclusion

The study offers benchmark data related to the usage patterns of the chat service at Umeå University Library. The findings of the study can possibly contribute to the advancement of the virtual reference service of the Umeå University Library by presenting the questions frequently asked, the outcomes of the chat sessions and the extend of the referrals. The study exposes the evolution of the questions categories throughout the period studied and strengths and weaknesses in the information provided by the informants. Consequently the results of the study can contribute in efficient decisions about training and staffing management.

Despite the limitations, the results of this study entail a large range of implications for the chat service. First, from a practical perspective, the empirical data gathered demonstrate that generic reference questions such as holdings and *account related questions* are more effectively answered through the chat system than more specific or technical questions. Second, the recurring policy questions may point towards the revision or the expansion of the current strategy. Third, the technical problems linked to evaporation should be prioritized by the library management in order to increase the number of questions answered in real time. Last, in the context of a single-library virtual reference service, referrals will still occur, as the probability of answering completely all the questions through a single service is highly implausible.

Consequently, facing challenges such as higher expectations from patrons in the digital age, Umeå University Library should be ready to offer a complete chat reference service by monitoring the service question-answer process effectiveness and coordinating its personnel and resources accordingly.

However the phenomenon of chat service is not settled yet in the college world and remains one of many digital services offered to the students (Meert & Given, 2009). The lack of its standardization and establishment as a communication and information medium can influence the consideration given by the management and consequently by the staff attending it. As the chat agents are neither scheduled nor located in the library premises, it seems difficult to give the same acknowledgement compared to the reference information desk.

8.1 Limitations

The lack of standardized question typology in the field of chat reference service research can impact negatively the recognition of the adopted classification for the study, and consequently the results.

Besides, this thesis examines transcripts from one particular university library and the findings cannot be generalized to all other form of libraries but it provides an example that can suggest some similarities with other synchronous virtual information services.

It is noticeable that this study did not focus on the reference interview and its connection to holdings requests which could lead to a greater understanding of users' actual needs.

8.2 Future research

Chat services should be monitored not only for statistical purposes but also to adapt the service to the demands and therefore using a focus group or performing a user survey of both the librarians and the patrons could give a more detailed picture of the impact of this particular service. As Durrance (1998) suggests, analyzing the opinions of the patrons using that service in order to understand the reasons they favor this service among the possibilities they are offered to communicate with the library would support the communication management at the library.

As Pomerantz (2005) explains, the acceptance of the virtual service might not reflect its usage. Consequently a statistical comparison with other information services provided by the university library such as email or phone communication and desk reference services could give a more detailed picture of the impact of the chat-based information service. Besides, the process of referral in the chat context can be an acceptable answer from an information provider perspective but considering the opinions from a user angle, this situation can be in conflict with the expectations of a synchronous service (Matesson et al., 2011).

Another possibility is to focus on the patrons' information seeking strategies in order to improve the website and optimize the information literacy. Continuous efforts to conceptualize the chat reference service in multiple dimensions should support the understanding of this complex form of interaction and this data collection can support the evaluation of the library web pages, explain Van Houlson et al. (2007).

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Appendices

Appendix A: Classification of information requests with examples

Classification of information requests	Definition	Examples
ebooks & online articles	Information and instruction about digital material	Patron: "En artikel som finns med i kurslitteraturen [...] tillgänglig online via universitetsbibliotek. [...] Har fått en länk men där krävs login. Hur kommer jag åt artikeln?" (106)
various related questions	Information and instruction requests coming from non-patrons or not related to any other category	Patron: "En av författarna behöver ett avtal som visar att vi godkänner att hon publicerar sin text i sin egen avhandling också. Har ni någon mall för avtal av den typen?" (86)
account related information	Printings credits, modifying account settings, etc.	Patron: "Jag är osäker på om jag har någon inloggning-kan ni hjälpa mig att kolla det alternativt ordna en?" (93)
book reservations & loans	Information and instruction requests about book reservations and loans	Patron: "Jag har reserverat en bok som nu har kommit. Men kursen är slut nu så jag behöver den inte. Hur gör jag då?" (80)
research related inquiries	Research process and academic writing support	Patron: "Jag ska börja skriva mitt examensarbete nu för förskollärare och tänkte höra om ni kan ge förslag på någon bra artikel angående modersmålsstöd/undervisning i förskolan?" (85)
Interlibrary loans & articles orders	Information and instructions about distance services offered to patrons	Patron: "Går det att beställa artiklar som ej finns i fulltext i er artikeldatabas?" (57)
book renewals & returns	Information and instruction about books renewals and returns	Patron: "Jag undrar vad som händer om man är sen med sin kursbok en dag eller två? Blir det förseningsavgift direkt?" (105)
technical issues	Technical support in relation to identified dysfunctions	Patron: "Jag var och skannade några papper tidigare idag. Det verkade fungera men har inte fått något mail ännu" (78)
item requests & purchase suggestions	General search for a particular item in the library catalogue and purchase suggestions related or not to the library catalogue content	Patron: "I would like to ask if the library can purchase a DVD." (81)
no questions	Initial contact from a patron or other personnel, including sometimes a content but no questions	Patron: "Hej" (196)

Appendix B: Causes of incomplete answers with examples

Causes of incomplete answers	Definition	Examples
technical issue	When the chat ends prematurely due to technical issues	Patron: "Tar det lite tid innan det funkar? " (131)
librarian evaporation	The patron initiates a question but does not receive any acknowledgement from the librarian	Patron: "Kan ni hjälpa mig?" (153)
patron evaporation	The patron initiates a question and then disappears in the course of the discussion	Librarian: "Välkommen att höra av dig igen!" (162)
other answer form	The patron asks to be answered through another medium or is invited to be recontacted through another communication mean	Librarian: "Jag behöver dina kontaktuppgifter [...] så hoppas jag att du får svar under dagen." (161)
referral	The query cannot be answered directly and the patron is invited to contact another personnel or institution.	Librarian: "Du kan kontakta [...] för endnotefrågor." (8)

Appendix C: Referral destinations with examples

Referral destinations	Definition	Examples
library department	Other personnel from the university library	Librarian:“Det går bra också att kontakta någon direkt kanske enklast per telefon: http://www.umu.se/kontakta/fjarrlan ” (136)
research librarian	A subject specialist with more in-depth information	Librarian:“Jag känner att det vore nog bäst om du kontaktar en expert[...]han jobbar/undervisar inom juridik” (69)
IT office	The IT office gives technical advices and support the users	Librarian:“Vill du komma i kontakt med någon i webbteamet? [...] är webbutvecklare här ”(59)
other departments	Unrelated to the university library	Librarian:“Perhaps it is a film that is of interest for Folkets bio?” (177)