

Chat Transcripts in the Context of the COVID-19 Pandemic: Analysis of Chats from the AskAway Consortia

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Article abstract

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Methods – The following programs were used to evaluate the dataset of more than 70,000 transcripts: R, Python (pandas), Voyant Tools and Linguistic Inquiry and Word Count (LIWC).

Results – Our findings indicate that the content of questions remained largely unchanged despite the COVID-19 pandemic and the related increase in volume of questions on the AskAway chat service.

Conclusion – These findings suggest that the academic libraries covered by this study were well-poised to provide continued support of patrons through the AskAway chat service, despite an unprecedented closure of physical libraries, a significant increase in chat volume, and a time of global uncertainty.



Research Article

Chat Transcripts in the Context of the COVID-19 Pandemic: Analysis of Chats from the AskAway Consortia

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Abstract

Objective – During the COVID-19 pandemic, the majority of post-secondary institutions in British Columbia remained closed for a prolonged period, and volume on the provincial consortia chat service, AskAway, increased significantly. This study was designed to evaluate the content of AskAway transcripts for the 2019-2020 and 2020-2021 academic years to determine if the content of questions varied during the pandemic.

Methods – The following programs were used to evaluate the dataset of more than 70,000 transcripts: R, Python (pandas), Voyant Tools and Linguistic Inquiry and Word Count (LIWC).

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Conclusion – These findings suggest that the academic libraries covered by this study were well-poised to provide continued support of patrons through the AskAway chat service, despite an unprecedented closure of physical libraries, a significant increase in chat volume, and a time of global uncertainty.

Context

This study was designed to evaluate the content of AskAway transcripts for the 2019-2020 and 2020-2021 academic years in response to this question: Did the types of questions, or the substance of those questions, change during the COVID-19 pandemic? Our hypothesis was that the questions would differ when compared with the pre-pandemic period. We were curious about what could be learned about academic library patron needs during this time, based on changes in language usage and the types of questions asked. What could we ascertain about reference needs in this time period, and how could that help us to prepare for future service disruptions? Could anything be discovered about unique information needs during a pandemic?

Chat reference in post-secondary libraries in British Columbia, Canada is provided through AskAway, which is described as “a collaborative service that is supported and staffed by post-secondary libraries from BC and the Yukon” and comprises 29 member libraries (BC ELN, 2022a). The member libraries represent a diverse set of institutions, from private two-year colleges to large publicly funded research universities that span an enormous geographic area and represent both rural and urban settings (BC Stats, 2018). AskAway was established in 2006 and has since been an important part of library services at all participating institutions. When the pandemic was declared in March 2020 (World Health Organization, 2022), physical libraries were closed and chat reference was perceived by most libraries as the primary means of service provision. This shift is described by Hervieux (2021) as moving chat reference from the margins of a service model to a “vital community service in a time of great uncertainty” (p. 267), a sentiment echoed by Radford et al. (2021) who describe chat during the pandemic as a “premier essential user service” (p. 106).

The long-term closure of academic libraries in British Columbia was unprecedented, with many libraries remaining closed for up to 18 months (BC ELN, 2021). During the height of the pandemic, demand for AskAway chat reference services increased by 62% over pre-pandemic years. Post-secondary students also reported severe disruptions in their studies, finances and career plans (Statistics Canada, 2020). Foreshadowing our findings, Lapidus (2022) and Watson (2022) nonetheless found that “for some institutions at least, the existing online reference infrastructure was capable of absorbing the demand during the pandemic” (Watson, 2022, p.11).

In order to address the pandemic-specific questions that we had of the dataset, the standard practice of comparing academic years was deemed to be inadequate. As such, we created a timeline for analysis tied

to key dates in the pandemic. September 2019 through March 2020 is the pre-pandemic timeline; the pandemic was declared on March 11, 2020, and BC post-secondary institutions closed on different dates throughout the month. April 2020 through December 2020 is the main pandemic period when institutions were fully online and library buildings were primarily closed. January 2021 through August 2021 represents a lessening of restrictions in BC and the reopening of libraries on different dates in advance of the 2021-2022 academic year; we refer to this period as late pandemic. The natural ebb and flow of the academic year is not reflected in the pandemic timelines and each time period includes regular term peaks and intersession breaks.

Literature Review

Academic Library Chat Reference Analysis

Virtual reference is defined as a “reference service initiated electronically for which patrons employ technology to communicate with public services staff without being physically present” (Reference and User Services Association, 2017). Academic library virtual reference services began in the 1990s and were in widespread use by the 2000s, allowing services to reach users at their point of need (Francoeur, 2001; Sloan, 1998). Research has found that chat services have resulted in a decrease in library in-person visits as more people access Web resources on home computers (Francoeur, 2001; Harlow, 2021). With physical space closures and public safety measures being implemented by libraries during the COVID-19 pandemic, reliance on chat reference increased which resulted in a renewed urgency to examine this topic (De Groote & Scoulas, 2021; Hervieux, 2021; Kathuria, 2021). While there are many studies evaluating different aspects of chat reference, this literature review is focused on methodological approaches for unearthing meaning and evaluating language in academic library chat transcripts.

In an effort to discover and understand the complex behaviors, experiences, and interactions between virtual reference chat users and librarians, chat transcript analysis has moved beyond usage statistics and standardized question tagging to a more contextualized examination of transcripts using transcript-harvested data-based topic modeling, sentiment analysis, and visualizations (Wang 2022, Chen & Wang, 2019; Ozeran & Martin, 2019). This developing analysis trend has technical limitations in its implementation and the lack of a standardization for evaluation (Chen, 2019; Grabarek & Sobel, 2012; Harlow, 2021; Kathuria, 2021; Ozeran & Martin, 2019). Grabarek and Sobel (2012) highlight the challenges of anonymous data in evaluating social and emotional meaning. Further exploration with larger datasets and chat transcripts over longer and various date ranges for comparison may elucidate more areas of interest, and visualization tools will be helpful for analysis (Chen & Wang, 2019; Ozeran & Martin, 2019). Sharma, Barrett and Stapelfeldt (2022) utilize a Python library and Tableau for visualization, demonstrating the utility of mixed method analysis. Walker and Coleman (2021) explore machine learning as a method for examining the complexity of chats with a large dataset.

The use of coding methods is heavily utilized in chat transcript analysis to examine meaning and satisfaction, yet large datasets often make this impractical without relying upon sampling. Schiller (2016) used the Cultural-Historical Activity Theory framework to conduct their analysis, generating a codebook and a cluster analysis to determine relationships. Logan, Barrett, and Pagotto (2019) used SPSS to code chat user satisfaction based on transcripts and exit surveys. Harlow (2021) coded nursing chat transcripts using Atlas.ti to evaluate reference efficacy. Logan and Barrett (2018) coded a sample of chats to evaluate the relationship between provider communication style and patron willingness to return; chi-square tests were used to assess this relationship. Kathuria (2021) utilized a two-part method of grounded theory tagging followed by sentiment analysis using R to evaluate positive and negative sentiments. Grounded

theory has been used in many studies as part of a mixed methods analysis to examine meaning (Harlow, 2021; Mungin, 2017; Smith et al., 2016).

Chat Reference in Libraries During COVID-19

A number of studies which examine chat services and transcripts in the context of the COVID-19 pandemic have already been published, and many found an increase in chat volume when academic libraries, along with their institutions, closed their doors and shifted to remote instruction and services (De Groote & Scoulas, 2021; Hervieux, 2021; Kathuria, 2021; Lapidus, 2022; Radford et al., 2021). When comparing chat transcripts between Fall 2019 and Fall 2020, Hervieux (2021) found that while “percentages of each type of interaction were fairly similar...with known items, circulation and reference queries making up the majority of the questions asked,” there was a “substantial difference” in questions about branch library information due to COVID-protocols and procedures applied to study spaces (p. 275-6). Kathuria (2021) found that “questions about accessing and returning the physical collection grew the most during COVID” (p. 112). Other questions that increased included those regarding fines and fees, library hours and technical troubleshooting (Kathuria, 2021). An increase in questions regarding course and assignment support and assignments has also been noted (Hervieux, 2021; Kathuria, 2021). Alternatively, Watson (2022) compared the University of Mississippi Libraries’ pandemic chat data to a pre-pandemic period and found no increase in chats and no significant difference in word frequency in chat transcripts. Graewingholt et al., (2022) argue that review of chat transcripts, regardless of the pandemic context, can further support revisions, adjustments, and improvements to library services.

Multiple methods of analysis for examining chat reference during the COVID-19 pandemic have been utilized. Hervieux (2021) used qualitative coding and quantitative metadata analysis to examine both the complexity and duration of chats. Hervieux (2021) concluded that more questions were being asked, more downtime during a chat was occurring, and that “librarians and patrons use more relational cues during their interactions” (p. 277). Kathuria (2021) used a grounded theory of analysis relying on coding and sentiment analysis in R and found an increase in negative sentiment when comparing pre-pandemic and pandemic chats. Radford, Costello & Montague (2021) relied on surveys and interviews to inform their examination of patron chat behavior and service perceptions. DeGroote & Scoulas (2021) also used patron surveys and paired this with statistical analysis to examine library use patterns during COVID-19. Lapidus (2022) conducted statistical analysis of metadata to understand reference services overall, including chat. Watson (2022) analyzed metadata and word frequency utilizing NVivo and Voyant in a multi-method approach not dissimilar from that reported in this study. Finally, Graewingholt et. al. (2022) started with machine classification followed by manual coding to understand trends in questions and inform training. Consensus on how to best evaluate large chat datasets has not yet emerged within the literature.

Methods and Tools

Data Acquisition

AskAway chat data for this study covering September 1, 2019 to August 31, 2021 were obtained from software vendor LibraryH3lp. Names, email addresses, student numbers, and other information that could lead to patron or service provider identification were removed by LibraryH3lp in accordance with the BC ELN privacy policy. In addition, four categories of chats were removed prior to data acquisition: chats from a university that withdrew from the service early in the timeline being studied, chats where

the privacy script was employed by service providers, practice chats, and chats fewer than five seconds in length.

Based on these criteria, LibraryH3lp provided two datasets: AskAway transcripts, containing chats between patron and provider with each chat as an individual text file for a total of 70,728 chats; and AskAway metadata, containing chat metadata, including start date, start time, queue, duration, and tags. Tags are standardized categories applied to chats by service providers (AskAway, 2022). This second data set consisted of 73,483 rows, one row for each chat, suggesting 2,754 additional records than were included in the transcript data set; this discrepancy is discussed below.

Data Description

AskAway transcripts are composed of four elements: a header with metadata, system text (like a welcome message), provider text, and patron text. These transcripts, like most chat data, are not well-structured. The informal nature of chat communication and the lack of standardization or error correction across chats (as an example, 'Thank you', vs 'Thank-you', vs 'Thankyou', vs 'Thnkyou'), present challenges in derived analyses. These challenges are further exacerbated by a variety of other features of chat data: the use of shorthand, such as emoticons and acronyms; a need to be expressive in a text environment, resulting in things like excessive punctuation; fast typing resulting in misspellings and excess white space; and content pasted from other sources introducing a variety of printed and non-printed characters. These features of the data set make even basic descriptive statistics, such as word counts, challenging. Conceptually, we can see this when comparing the terms 'meta data' and 'metadata', counted as two words and one word, respectively.

AskAway metadata is highly structured data and consists of two categories: system-generated and provider-generated. System-generated metadata include variables such as time stamps, institution, and duration. Provider-generated metadata consists of tags, of which there are thirty available (AskAway, 2022). Service providers select those most appropriate to the chat to represent the interaction; multiple tags can be selected and there is no free-text option. In March 2020, AskAway advised service providers to apply the tag "Other" to COVID-19 chats and in June 2020, AskAway introduced a new COVID-19 tag to indicate if a question was specifically related to an aspect of the pandemic.

LibraryH3lp was unable to provide an explanation for the discrepancy between number of transcripts provided and number of chats suggested by the metadata dataset. To investigate this further, metadata was extracted from the transcripts and compared against the metadata dataset. While a definitive conclusion could not be derived, noted anomalies such as the duration time stamps occasionally being off by a second, suggest minor errors in the collection of data attributed to this inconsistency. Representing just under 4% of the transcript data, this discrepancy was considered manageable for the purposes of this study.

We added a field to the metadata to classify participating institutions by the size of their student body using the value of Full-Time Equivalent (FTE). FTE numbers were derived from BC ELN (2022b), and divide post-secondary institutions into three categories, as shown in Table 1.

Table 1
AskAway Post-Secondary Institutions by FTE

Institution size	FTE Count	Number of Institutions
Small	4,999 or less	18
Medium	5,000-9,999	9
Large	10,000 or more	4

Data Cleaning & Preparation for Analysis

AskAway transcript data was iteratively cleaned and organized using R. The text chats were initially merged into a single data set, and all system-generated text and metadata stripped from the main corpus; metadata remained associated with the text and allowed for subsequent subsetting of the data. Several subsets of the data were produced, including patron-only transcripts, provider-only transcripts, and time series transcripts. As part of this process, general cleaning included removal of excess white space, conversion to lowercase, and stripping of punctuation. Single text files of each subset were then produced for analysis.

The AskAway metadata dataset arrived clean with no post-processing needed, other than including additional data about the FTE category. To prepare the data for use in LIWC, a small modification to the original datasets was made: replacing the strings 'https://' and 'http://' with the string 'URL,' as the element ':/' was being interpreted as an emoticon and skewing the scores for the tone dimension analysis.

Selection of Text Analysis Tools

With a dataset of 70,728 items, the research team used multiple approaches in an attempt to find patterns and meaning. Uncertain of which tools and techniques would be the most appropriate for examining meaning in large bodies of chat text, we first ran a random sample of the LIWC, AskAway transcript (n = 3,800) through a series of text analysis applications. This allowed us to assess the general format and contents of the dataset and to identify the most appropriate tools to address our research questions. The test analysis was run in the following programs: R, Atlas.ti, NVivo, Python (pandas), Voyant, LIWC, and OpenRefine. Based on functionality and researcher expertise, R and Python (pandas) were selected for metadata and quantitative chat analysis. LIWC and Voyant were selected as tools to explore meaning in the chat transcripts.

Voyant Tools

Voyant Tools is a suite of Web-based textual analysis tools used in digital humanities (Sinclair & Rockwell, 2022). Voyant allows for text files to be explored and visually represented in an easy to manipulate interface; it is particularly useful for examining patterns within texts. Of particular relevance to this analysis were the Cirrus, Document Terms, Terms Berry, and Trends tools; these were used to determine patterns and meaning within each dataset and between them.

Linguistic Inquiry and Word Count (LIWC)

LIWC is a software program focused on identifying people's social and psychological states from the language they use. LIWC achieves this by calculating word count distributions in psychologically meaningful categories (Tausczik & Pennebaker, 2010). The current version, LIWC-22, uses over 100 built-in dictionaries consisting of words, word stems, emoticons, and other verbal structures to capture several psychological categories (LIWC, n.d.). Since our objective was to assess if there was a difference between the types of inquiries received by AskAway throughout the pandemic, and not to evaluate linguistic characteristics per se, we focused on the summary dimensions, described in Table 2.

Table 2
LIWC Summary Dimensions

Summary dimensions	Description
Analytic	Captures the use of formal, logical, and hierarchical thinking patterns. Low scores correspond to intuitive, personal, and less rigid language. High scores suggest more formal or academic language correlated with higher grades and reasoning skills.
Clout	Refers to language related to social status, confidence, or leadership.
Authenticity	Describes self-monitoring language, associated with levels of spontaneity. Higher scores in this category mean use of less "filtered" language, while prepared texts tend to have lower scores.
Tone	Puts positive and negative emotional tones into a single summary variable. The higher the number, the more positive the language, while scores below 50 suggest a more negative tone.

Analysis

Metadata Analysis

Using both R and Python (pandas), the metadata for the full dataset was analyzed for insights into question types, distributions and trends. In general, the data indicate changes in volume more so than any other element. For example, the pandemic was officially declared on March 11, 2020 and March 23, 2020 was the busiest single day on AskAway throughout the study period. Figure 1 below depicts the distribution of questions asked on AskAway between September 2019 and August 2021, totaled by month, and colour-coded to represent the pandemic timeline.

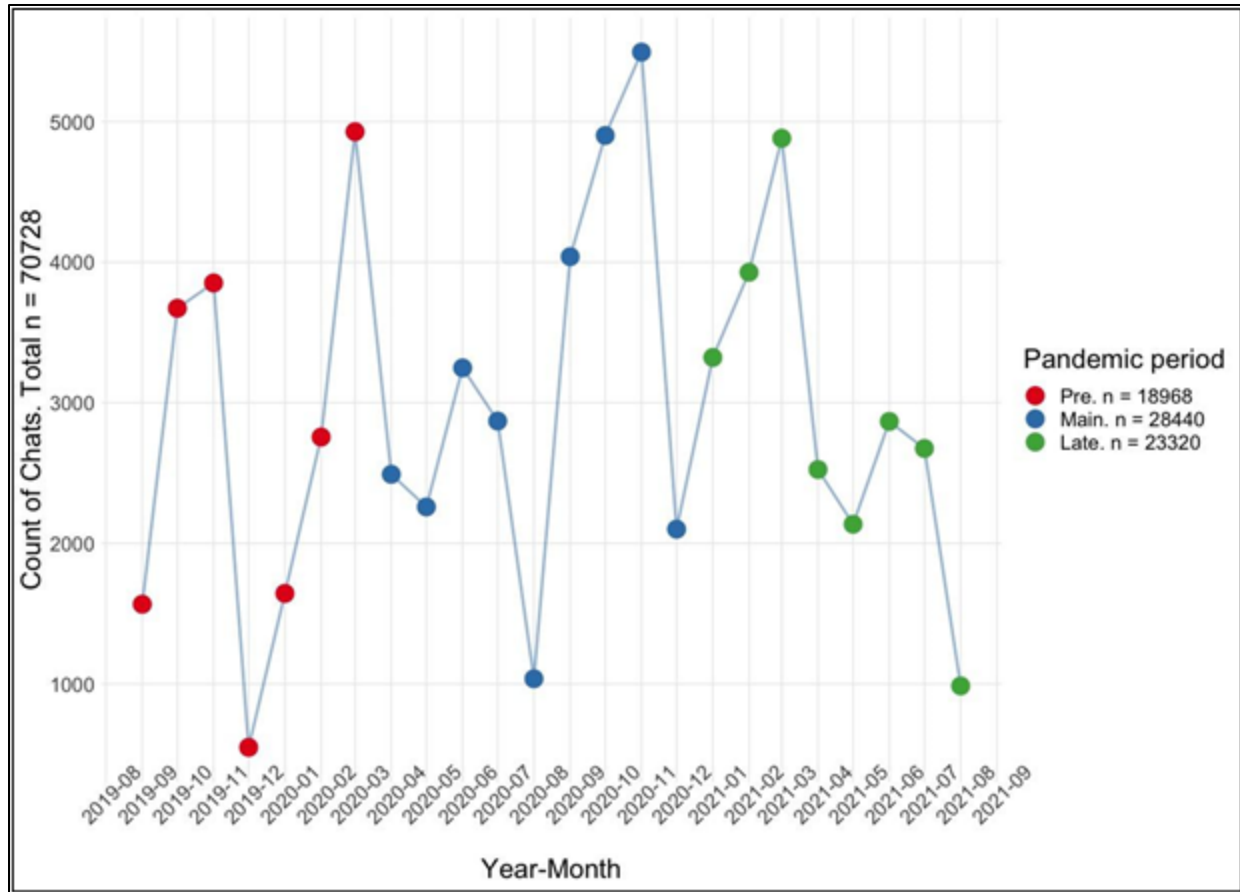


Figure 1
Total chats by month and pandemic timeline.

The AskAway service supports a variety of post-secondary institutions that differ in size, program type, geography, and urban/rural locality. Figure 2 depicts the distribution of questions asked over time by the size of the post-secondary institution by enrollment. While the pattern in the data follows the same trajectory as is depicted in Figure 1, when the data is broken out by institution size, we see that medium-sized institutions consistently account for a high proportion of questions asked. We also see that, after the pandemic was declared, the number of questions asked from the larger institutions accounts for a substantial portion of the increase in volume. Despite these increases in volume from larger institutions, which include the research-intensive universities, there is no evidence in our data that the question types themselves were altered.

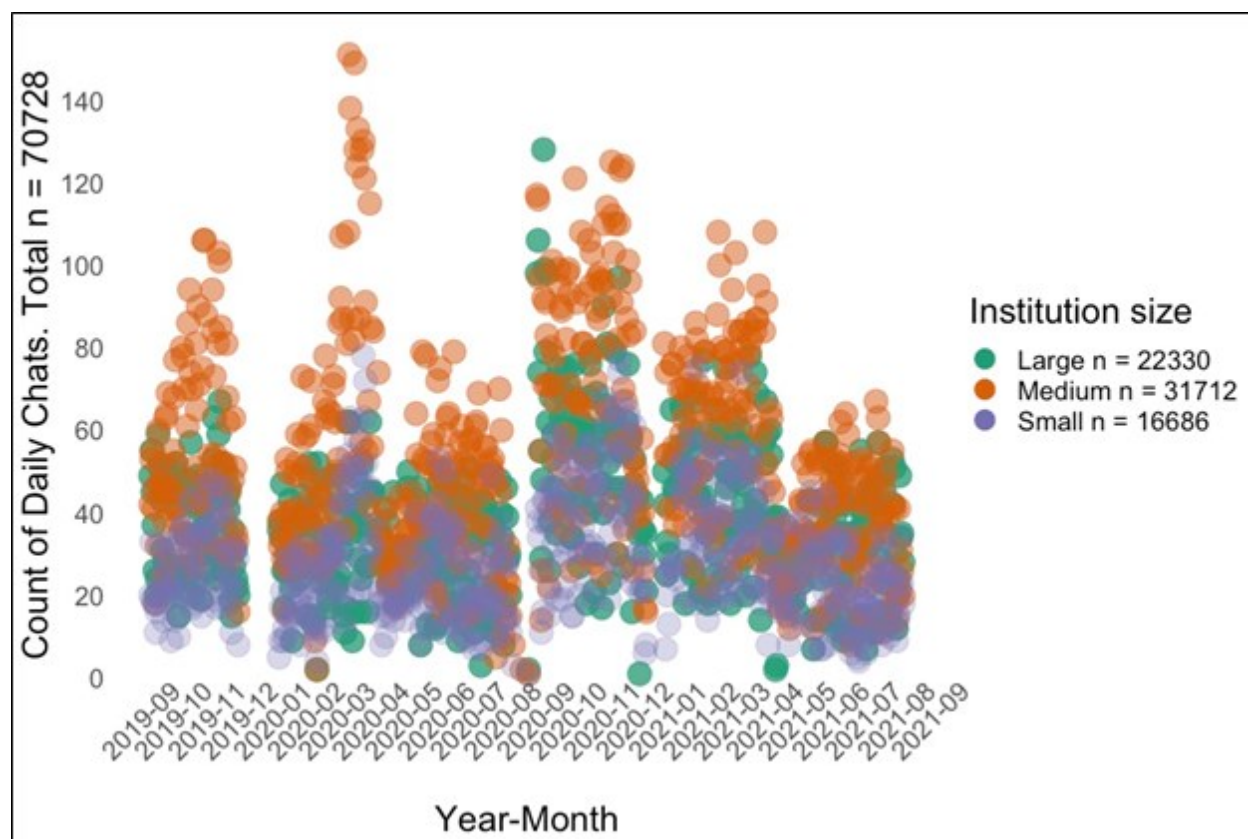


Figure 2
Timeline of total chats by institution size and pandemic timeline.

AskAway tags are well-defined for collective usage (AskAway, 2022) and analysis of them shows very clearly that, from the service provider's perspective, the type of questions asked on AskAway did not change substantially during the pandemic. Figure 3 demonstrates the remarkable consistency in the types of questions asked throughout our study period through a display of the top 10 tags in our dataset, isolated by pandemic period. Note that there are 12 tags in Figure 3. The top 10 tags for each period were extracted and then collated; not all tags below would have been in the top 10 for the dataset as a whole. The top 7 tags in Figure 3 were in the top 10 for all 3 periods, as was the tag 'technical'. The remaining 4 tags were in the top 10 for only 1 or 2 periods (no question in 'pre', COVID-19 in 'early', InterLibrary Loan in 'pre' and 'main', and referred in 'early' and 'main').

A few other aspects of the tags warrant highlighting. Circulation, referrals to "home library," and directional questions all increased from April 2020 onward. Interlibrary loan (ILL) questions are absent in the main pandemic dataset as ILL services were unavailable globally for much of that time. The presence of general referrals - directing patrons to services outside of the library - only in the main- and late-pandemic data suggests the important role that libraries played as a general campus service. The COVID-19 tag emerges in the top 10 tags during the main pandemic period but does not persist beyond December 2020. Despite these differences, we see remarkable consistency especially in those that account for the majority of the volume of activity.

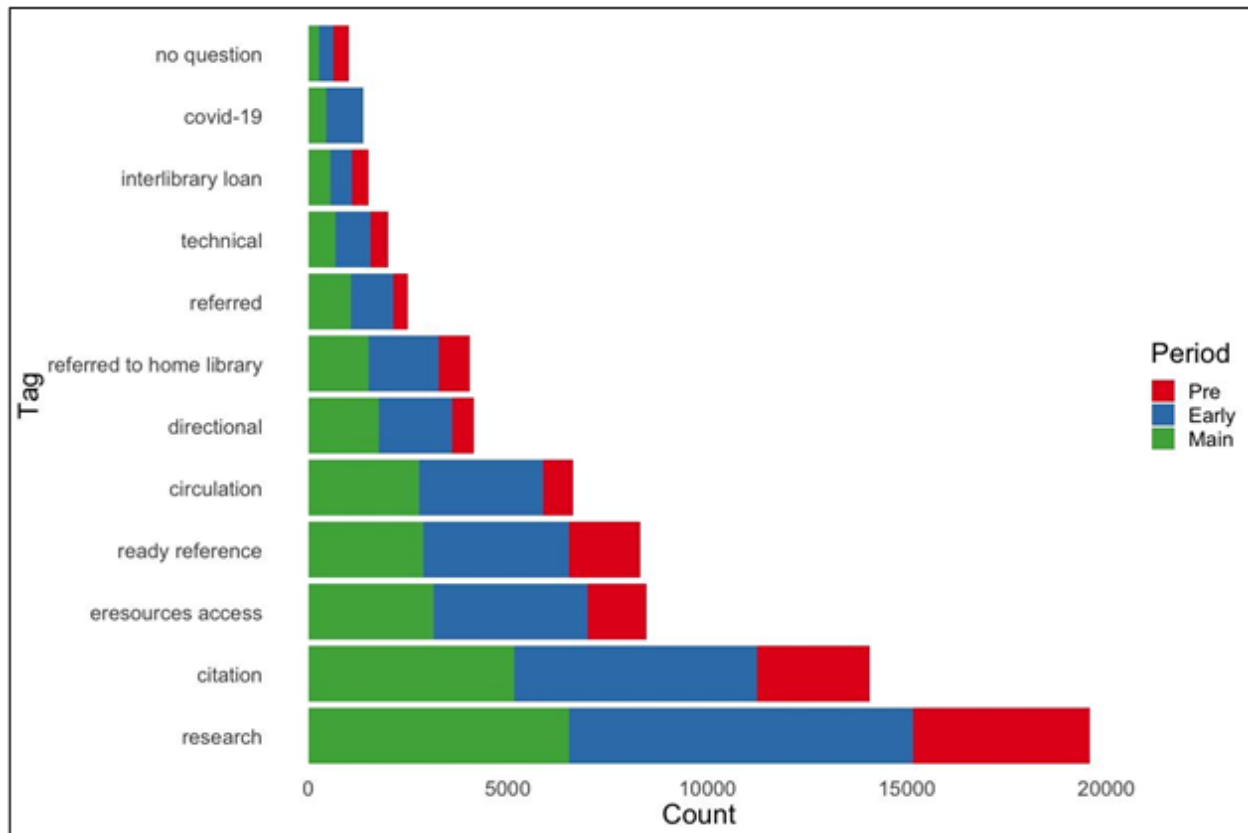


Figure 3
Top ten chat tags displayed by pandemic timeline.

Transcript Analysis

Table 3 details the transcripts in the pandemic timeline which form the basis of our subsequent analysis.

Table 3
Pandemic Timeline Datasets

Timeline	Transcript Datasets	Chats Per Dataset
Pre-pandemic: September 2019 - March 2020	all chats (patron & provider) patron only provider only	18,968
Main-pandemic: April 2020 through December 2020	all chats (patron & provider) patron only provider only	28,440
Late-pandemic: January 2021 - August 2021	all chats (patron & provider) patron only provider only	23,320

Table 4
Voyant Tools Analysis of Patron Chat

	Pre-pandemic	Main-Pandemic	Late-Pandemic
Average words per sentence	39.5	37.8	36.1
Vocabulary density	0.030	0.024	0.027
Readability Index	9.603	9.406	9.493
Total words	1, 683, 539	2, 959,334	2, 341, 374
Unique words	50, 039	71, 373	62, 735

Table 4 displays the summary report for the patron chat for each time period in Voyant Tools. These are values that Voyant Tools applies as a default to all analyses: average words per sentence, vocabulary density, readability, total words and unique words (Sinclair & Rockwell, 2022). The Readability Index is a calculation based on the BreakIterator class, which is a natural-language coding technique to determine word boundaries and syntax in text (Oracle, 2022). While these values are not inherently insightful, when examined in comparison across the time periods they demonstrate remarkable similarity on each metric, reinforcing our overall findings.

Word frequency was used to explore patron voice in the transcripts across each pandemic time period. There are a total of 214,418 unique words in all of the patron transcripts. Using R, we extracted the 1,000 most frequently used words, consisting of 4 or more characters, from each time period. There are 1,135 unique terms in total that meet these criteria, of which 871 are in all 3 time periods, and 264 are in only 1 or 2 of the time periods. Figures 4-6 present word clouds of the top 115 words from patron-only transcripts with the size of the word mapped to its frequency.



Figure 4
Pre-pandemic patron chat.



Figure 5
Main-pandemic patron chat.



Figure 6
Late-pandemic patron chat.

LIWC was employed to identify general trends in the sentiments expressed in our dataset, an approach similar to Kathuria's (2021) sentiment analysis. The LIWC dimensions of analytic, clout, authentic, and tone were used to evaluate potential changes in both patron and provider transcripts. Linguistic scores between patron and provider were compared to evaluate similarities or differences in language used. Table 5 presents the scores and change percentages for the LIWC dimensions for both patron and provider transcripts.

Table 5
LIWC Dimensions Analysis By Pandemic Timeline

	Word Count	Analytic	% change	Clout	% change	Authentic	% change	Tone	% change
Provider Chats									
Pre	3,633,999	52.66	n/a	81.13	n/a	28.69	n/a	80.78	n/a
Main	6,149,448	52.62	-0.07	79.2	-2.37	27.03	-5.78	76.43	-5.38
Late	4,997,628	54.51	3.60	80.24	1.31	25.99	-3.85	77.37	1.22
Patron Chats									
Pre	1,682,967	39.28	n/a	15.2	n/a	55.89	n/a	89.32	n/a
Main	2,959,063	37.92	-3.46	15.33	0.85	56.72	1.48	89.52	0.22
Late	2,340,394	38.7	2.05	15.72	2.54	56.71	-0.01	91.3	1.99

Analytic scores were nearly identical for providers pre-pandemic and in the beginning of the pandemic, indicating similar levels of formality in language. An increase of 3.59% was observed in the late phase of the pandemic. Overall, analytic scores remained relatively similar for both providers and patrons, with small changes in between periods (less than 4% change for both user groups). When comparing scores between patron and provider chats, the Analytic score was considerably higher for providers, indicating the prevalent use of formal language by AskAway librarians.

Clout was consistently high for provider responses, with a 2.38% decrease in the main pandemic stage, and a return to near pre-pandemic scores in the late pandemic stage. For patron chats, even though a slight increase in clout occurred over time, the levels remained low throughout all phases. These numbers indicate that the language used by providers translates to higher status, confidence, or leadership when compared to patron chats and that rates did not change substantially during the pandemic.

Levels of authenticity were consistently low for provider chats in relation to patron chats, and these levels decreased as the pandemic progressed. Authenticity was high for patron chats, with levels consistently above 50% and a slight increase during the pandemic. For provider chats, a more pronounced decrease in authenticity occurred.

Both providers and patrons had positive emotional tone (scores consistently higher than 50), but patrons had higher positive language than providers both before and during the pandemic. An inverse trend was observed: while positive language in provider chats declined during the pandemic (5.78% decline from pre-pandemic levels and 3.84% decline between pandemic phases), scores for patron chats had a small increase (less than 3% between pre-pandemic and pandemic levels).

Discussion

This study aimed to evaluate the type and substance of chat reference questions in an effort to understand a vital aspect of academic library services during the COVID-19 pandemic. Researcher expectations were that the type of questions would differ, in large part because the experience of providing only virtual services seemed so different. However, similar to Hervieux (2021), our expectations are not supported by the data. By examining AskAway transcripts and metadata, we found homogenous results which demonstrated more consistency than difference in the types of questions asked.

The use of Voyant Tools to explore patterns and interpret meaning in the transcripts focused on the patron transcripts. When examining word frequency over the pandemic timeline, the numbers indicate remarkable consistency in the words used by patrons over time. Despite all of the social and economic impacts of the pandemic, the shift to online-only classes, and the closures of our physical libraries, this snapshot captured in the word cloud figures depict the overwhelming use of AskAway for library-specific questions that focus on research involving citation and locating and accessing sources of information. Analysis using the Terms Berry feature duplicates the Cirrus results, and the Trends tool did not prove insightful with the transcripts.

LIWC shows a slight increase in analytic scores in the late pandemic which might be correlated with increased use of pre-scripted language as a provider strategy to deal with the increased volume on AskAway. This would also explain declining rates in the authenticity dimension as pre-scripted language is considered less authentic in LIWC. Though it is difficult to confirm exactly why this is the case without qualitatively examining more closely the interactions between providers and patrons, it is possible that

certain patterns in provider messages and scripts, such as higher use of articles, can indicate higher analytic thinking and formality (Jordan et al., 2019). Analytic scores of patron responses had more fluctuation between phases than those of providers. However, similar scores in the pre and late periods suggest that the main pandemic period may have in fact been a bit of an anomaly.

As observed by Kacewicz et al. (2014), the use of first-person plural pronouns and an "outer-focus" language correspond with higher scores in the LIWC clout dimension, and this might serve as a potential explanation for the large discrepancy between provider and patron chats. For example, several AskAway scripts use the pronoun "we" as part of their composition, particularly the script used at the end of a chat, so the use of plural personal pronouns may be contributing to higher provider scores in this category, as opposed to other types of words that correlate to higher confidence or social status. Regardless, levels of clout did not change considerably during the pandemic, with changes to percentages remaining lower than 3% for both patron and provider chats.

The decrease in the LIWC authenticity dimension for providers in the main and late pandemic may again be associated with increased use of pre-scripted messages, which tend to be formulated using neutral language and with higher use of third-person pronouns. Since high authenticity is correlated with use of first- and third-person singular pronouns (I, he, she), as described by Kalichman & Smyth (2021), the increase of pre-scripted language that does not match those characteristics can help explain the low scores for providers and the differences when compared to patron chats. We can infer from these numbers that patrons use more spontaneous language when compared to providers, and that levels of spontaneity for patrons have not changed substantially during the pandemic.

The difference in emotional tone scores between patron and provider chats may be explained by certain patterns in provider responses and in how some AskAway pre-formatted scripts are written. For example, the word 'lost' is assigned to a negative emotional category in the LIWC dictionary. It also happens to be part of a script used to check if patrons are still online after a period of inactivity (*Check in - lost* script). Coincidentally, "lost" was the negative word that appeared most frequently in provider chats before and during the pandemic. Similarly, "worries" also had high frequency in provider chats, but this word appears to be part of the expression "no worries," an alternative to "you're welcome." This suggests that emotional tone should be viewed with caution in this dataset, as individual words may not accurately represent the actual tone of a chat. The changes observed may be associated with the higher frequency of certain words due to increased number of chats, rather than a substantive change in emotional tone.

The main finding of consistent patron questions from April 2020 - August 2021 has important implications for academic library service provision and future planning. First, consistency in the question types points to similar patron expectations for chat interactions, regardless of class format and library building operations. Second, consistency in the question types, despite the large increase in volume, points to a need for flexible staffing responses in times of disruption or closure with sufficient training to respond to research, citation, and a broad scope of library service questions. Third, our findings have implications for staff training and expectation management in times of disruption, whether planned or unexpected. While we know that patrons' lives were upended during the pandemic, what they expected of their academic libraries, at least as evidenced through chat interactions, did not change. Future studies that compare patron expectations with patron behavior, in times of both normalcy and disruption, would further bolster this argument.

Limitations

Finally, as there are serious limitations to evaluating chat using quantitative methods alone, due to the fragmented nature of chat interactions, and because the volume of consortia chat does not easily lend itself to qualitative analysis, an improvement in the nuance of tags applied by providers would assist future assessment of the value of chat. As chat is poised to continue as an important element within the academic library service ecosystem, additional nuance in facilitating quantitative assessment of all reference services would be a welcome improvement.

Conclusion

This article reports on the analysis of over 70,000 chat transcripts from a diverse set of post-secondary institutions across British Columbia and the Yukon and finds that, despite a significant increase in volume during the pandemic, question types were remarkably consistent with those asked prior to the pandemic. The professional literature has long advised that academic libraries devote more attention to virtual services (Francoeur, 2001) but closing the physical operations of libraries during the pandemic significantly altered the urgency of this call (Radford et al., 2021). De Groote and Scoulas (2021) utilized a multi-method approach to understand the impact of COVID-19 on academic library use and found ongoing value for patrons in virtual service offerings. The insights offered in this paper lend confidence in articulating patron needs for chat reference as more than a supplemental service, but rather a cornerstone of service provision, during both stable and uncertain times. Echoing the findings of Mawhinney and Hervieux (2022), this paper also provides support to the argument that the questions asked by chat patrons are complex, with the largest segment of our dataset tagged as research in focus.

Author Contributions

Barbara Sobol: Conceptualization, Formal analysis, Methodology, Project administration, Visualization, Writing - original draft **Aline Goncalves:** Formal analysis, Methodology, Visualization, Writing - original draft **Mathew Vis-Dunbar:** Methodology, Visualization, Writing – review & editing **Sajni Lacey:** Literature review, Writing - review & editing **Shannon Moist:** Writing - review & editing **Leanna Jantzi:** Writing – original draft **Aditi Gupta:** Analysis, Writing – review & editing **Jessica Mussell:** Methodology, Writing - review & editing **Patricia L. Foster:** Literature review, Writing - original draft **Kathleen James:** Literature review, Writing - review & editing. We would also like to acknowledge Cristen Polley at BC ELN for facilitating access to the data.

References

- AskAway. (2022). *Tags*. <https://askaway.org/staff/tags>
- BC Stats. (2018). *College regions: Detailed wall map*. https://www2.gov.bc.ca/assets/gov/data/geographic/land-use/administrative-boundaries/college-regions/map_wall_college_regions_2018nov18.pdf
- British Columbia Electronic Library Network. (2021). *AskAway actions and achievements 2021* [Accessible version]. https://bceln.ca/sites/default/files/reports/AA_Actions_Achievements_2021_Accessible.pdf

- British Columbia Electronic Library Network. (2022a). *Participating institutions*.
<https://bceln.ca/services/learning-support/askaway/participating-institutions>
- British Columbia Electronic Library Network. (2022b). *Partner libraries: FTE information*.
<https://www.bceln.ca/partner-libraries/fte>
- Chen, X., & Wang, H. (2019). Automated chat transcript analysis using topic modeling for library reference services. *Proceedings of the Association for Information Science and Technology*, 56(1), 368-371. <https://doi.org/10.1002/pr2.31>
- De Groote, S. and Scoulas, J.M. (2021). Impact of COVID-19 on the use of the academic library. *Reference Services Review*, 49(3/4), 281-301. <https://doi.org/10.1108/RSR-07-2021-0043>
- Francoeur, S. (2001). An analytical survey of chat reference services. *Reference Services Review*, 29(3), 189-204. <https://doi.org/10.1108/00907320110399547>
- Grabarek Roper, K., & Sobel, K. (2012). Anonymity versus perceived patron identity in virtual reference transcripts. *Public Services Quarterly*, 8(4), 297-315. <https://doi.org/10.1080/15228959.2012.730396>
- Graewingholt, M., Coslett, C., Cornforth, J., Palmquist, D., Greene, C.R., & Karkhoff, E. (2022). Chatting into the void: Scaling and assessing chat reference services for effectiveness. In M. Chakraborty, S. Harlow, & H. Moorefield-Lang (Eds.), *Sustainable online library services and resources: Learning from the pandemic* (pp. 19-34). Libraries Unlimited.
- Harlow, S. (2021). Beyond reference data: A qualitative analysis of nursing library chats to improve research health science services. *Evidence Based Library and Information Practice*, 16(1), 46-59. <https://doi.org/10.18438/ebli29828>
- Hervieux, S. (2021). Is the library open? How the pandemic has changed the provision of virtual reference services. *Reference Services Review*, 49(3/4), 267-280. <https://doi.org/10.1108/RSR-04-2021-0014>
- Jordan, K. N., Sterling, J., Pennebaker, J. W., & Boyd, R. L. (2019). Examining long-term trends in politics and culture through language of political leaders and cultural institutions. *Proceedings of the National Academy of Sciences*, 116(9), 3476-3481. <https://doi.org/10.1073/pnas.1811987116>
- Kacewicz, E., Pennebaker, J. W., Davis, M., Jeon, M., & Graesser, A. C. (2014). Pronoun use reflects standings in social hierarchies. *Journal of Language and Social Psychology*, 33(2), 125-143. <https://doi.org/10.1177/0261927X13502654>
- Kalichman, S. C., & Smyth, J. M. (2021). “And you don’t like, don’t like the way I talk”: Authenticity in the language of Bruce Springsteen. *Psychology of Aesthetics, Creativity, and the Arts*.
<https://doi.org/10.1037/aca0000402>
- Kathuria, S. (2021). Library support in times of crisis: An analysis of chat transcripts during COVID. *Internet Reference Services Quarterly*, 25(3), 107-119. <https://doi.org/10.1080/10875301.2021.1960669>

- Lapidus, M. (2022). Reinventing virtual reference services during a period of crisis: Decisions that help us move forward. *Medical Reference Services Quarterly*, 41(1), 41-53.
<https://doi.org/10.1080/02763869.2022.2021033>
- LIWC. (n.d.). *Understanding LIWC summary measures*. <https://www.liwc.app/help/liwc#Summary-Measures>
- Logan, J. & Barrett, K. (2018). How important is communication style in chat reference? *Internet Reference Services Quarterly*, 23(1-2), 41-57. <https://doi.org/10.1080/10875301.2019.1628157>
- Logan, J., Barrett, K., & Pagotto, S. (2019). Dissatisfaction in chat reference users: A transcript analysis study. *College & Research Libraries*, 80(7), 925-944.
- Mawhinney, T., & Hervieux, S. (2022). Dissonance between perceptions and use of virtual reference methods. *College & Research Libraries*, 83(3), 503. <https://doi.org/10.5860/crl.83.3.503>
- Mungin, M. (2017). Stats don't tell the whole story: Using qualitative data analysis of chat reference transcripts to assess and improve services. *Journal of Library & Information Services in Distance Learning*, 11(1/2), 25-36. <https://doi.org/10.1080/1533290X.2016.1223965>
- Oracle. (2022). *Java documentation: About the BreakIterator class*.
<https://docs.oracle.com/javase/tutorial/i18n/text/about.html>
- Ozeran, M., & Martin, P. (2019). "Good night, good day, good luck": Applying topic modeling to chat reference transcripts. *Information Technology and Libraries*, 38(2), 59-67.
<https://doi.org/10.6017/ital.v38i2.10921>
- Radford, M., Costello, L., & Montague, K. (2021). Surging virtual reference services: COVID-19 a game changer. *College & Research Libraries News*, 82(3), 106-113. <https://doi.org/10.5860/crln.82.3.106>
- Reference and User Services Association. (2017). *Guidelines for implementing and maintaining virtual reference services*.
https://www.ala.org/rusa/sites/ala.org.rusa/files/content/GuidelinesVirtualReference_2017.pdf
- Sharma, A., Barrett, K., & Stapelfeldt, K. (2022). Natural language processing for virtual reference analysis. *Evidence Based Library and Information Practice*, 17(1), 78-93.
<https://doi.org/10.18438/ebliip30014>
- Schiller, S. Z. (2016). CHAT for chat: Mediated learning in online chat virtual reference service. *Computers in Human Behavior*, 65, 651-665. <https://doi.org/10.1016/j.chb.2016.06.053>
- Sinclair, S. & Rockwell, G. (2022). *Voyant Tools* (Version 2.6.1). [Text analysis app]. <https://voyant-tools.org/>
- Sloan, B. (1998). Electronic reference services: Some suggested guidelines. *Reference and User Services Quarterly*, 38(1), 77-81.

- Smith, M., Conte, J., & Guss, S. (2016). Understanding academic patrons' data needs through virtual reference transcripts: Preliminary findings from New York University Libraries. *IASSIST Quarterly*, 40(1), 20–26. <https://doi.org/10.29173/iq624>
- Statistics Canada. (2020, May 12). Impacts of the COVID-19 pandemic on postsecondary students. *The Daily*. <https://www150.statcan.gc.ca/n1/daily-quotidien/200512/dq200512a-eng.htm>
- Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology*, 29(1), 24–54. <https://doi.org/10.1177/0261927X09351676>
- Walker, J. & Coleman, J. (2021). Using machine learning to predict chat difficulty. *College & Research Libraries* 82(4), 683-707. <https://doi.org/10.5860/crl.82.5.683>
- Wang, Y. (2022). Using machine learning and natural language processing to analyze library chat reference transcripts. *Information Technology and Libraries*, 41(3), 1-10. <https://doi.org/10.6017/ital.v41i3.14967>
- Watson, A. P. (2023). Pandemic chat: A comparison of pandemic-era and pre-pandemic online chat questions at the University of Mississippi Libraries. *Internet Reference Services Quarterly*, 27(1), 25-36. <https://doi.org/10.1080/10875301.2022.2117757>
- World Health Organization. (2023). *Coronavirus disease: COVID-19 pandemic*. <https://www.who.int/europe/emergencies/situations/covid-19>