“Complexity of reference consultations for undergraduate and graduate students in an academic library”

AUTHORS	Naděžda Firsová Jana Hinke Luboš Smutka

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Naděžda Firsová (Czech Republic), **Jana Hinke** (Czech Republic),
Luboš Smutka (Czech Republic)

COMPLEXITY OF REFERENCE CONSULTATIONS FOR UNDERGRADUATE AND GRADUATE STUDENTS IN AN ACADEMIC LIBRARY

Abstract

Effective resource allocation is critical for academic libraries that offer reference consultations and information literacy instruction to support student success. The study aims to examine the time spent and the intensity and variation in information resource use across 671 reference consultations provided to undergraduate and graduate students at the Czech National Library of Technology, categorized by complexity levels. A case study methodology with quantitative analysis, including descriptive statistics and correlation tests, was applied. The results indicate that simple consultations require more extensive involvement of information resources with an emphasis on basic information literacy, while higher grades of consultations involve fewer resources but more frequent use of full-text databases. It is also shown that information resources are used consistently, with usage patterns reflecting the complexity of users' assignments and questions. The analysis shows that there is a significant relationship between consultation complexity and both the time spent providing a consultation (correlation coefficient 0.276) and the time spent preparing for the consultation (correlation coefficient 0.262). The results suggest the need for strategic planning of human resources based on service complexity to increase the efficiency of consultations, as well as more conscious decision making regarding the use of information resources in consultation services.

Keywords library, consultation, information resource, reference service, student, librarian

JEL Classification H41, L32, L86

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Naděžda Firsová, Ing., Doctoral Student, Czech University of Life Sciences Prague, Czech Republic.

Jana Hinke, Doc., Ing., Ph.D., Associate Professor, Czech University of Life Sciences Prague, Czech Republic. (Corresponding author)

Luboš Smutka, Prof., Ing., Ph.D., Professor, Czech University of Life Sciences Prague, Czech Republic.

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INTRODUCTION

Reference services have long been integral to academic libraries, offering students personalized research support through various means. However, in recent decades, there has been a noticeable decline in the number of reference service transactions (Maloney & Kemp, 2015; Vassady et al., 2015). Simultaneously, librarians have had to devote more time to carrying out these services (Warner, 2001) because of the increasing complexity of reference consultations (Jastram & Zawistoski, 2008). This shift has placed greater demands on librarians, who are now required to devote more time and expertise to each interaction, often through one-on-one consultations. As reference services move away from traditional desk-based interactions towards more tailored, research-oriented appointments, libraries must confront the challenge of balancing resource allocation. Academic libraries now face pressing challenges in balancing resource allocation with quality support, highlighting the need for a deeper understanding of both human and information resources for various complex consultations. However, research examining the efficiency of these resource allocations, especially across different complexity levels, remains limited, making this study essential for strategic library planning.

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1. LITERATURE REVIEW

Over the past few decades, reference services in academic libraries have evolved from service desk support based on navigation and basic information assistance to a broad range of support, including comprehensive one-on-one research consultations or coaching interactions. While the reference services involve different activities and require a variety of staff knowledge and skills, library managers have recognized that collecting and analyzing library reference statistics can improve the quality of decision making and help optimize processes at both the operational (e.g., scheduling service hours) and the strategic (e.g., planning collection and service development) levels (Warner, 2001). The definition of more useful reference service categories may benefit academic libraries and contribute to better standards for comparing activities across libraries (McLaughlin, 2011). Although advanced reference services require significant inputs, such as the total time spent by librarians and the specific information resources used, examining services in terms of their content and complexity has become one of the key issues for academic library management.

The traditional meaning of reference is defined as an assistance activity for an individual or group of users in response to a current information need, and it can complement instructional activities (RUSA, 2021). Reference service cannot be perceived as formal instruction initiated by an instructor in a classroom process, for example. In general, the main purpose of the reference service is to navigate the library user to the required or necessary information sources.

Despite changes in information-seeking behavior and the fact that a significant amount of reference transactions has been replaced by free resources available on the Internet, a library still provides valuable assistance in meeting users' immediate information needs. Importantly, Lambaria and Clark (2023) noted that the essence of the modern reference services is based on improving users' information literacy (finding, evaluating, and using information) to make them more informed, and these services should be provided proactively.

The history of one-on-one consultation began in the 1970s in U.S. college and university libraries, where their purpose was to support teaching, facilitate student learning, and replace some classroom activities (Jastram & Zawistoski, 2008). One-on-one consultations are designed as personal assistance, with an increasing amount of time spent by a user with a librarian to solve more complex questions. According to the study, the current evolution of reference services toward research consultation can be seen as a result of the growth of interdisciplinary and multidisciplinary research.

Recently, in the case of reference services provided by academic libraries to undergraduate and graduate students, the term individual research consultation can also be found in the literature. Stapleton et al. (2020) provide a comprehensive overview of research consultation. The research consultation is not precisely defined, and the author used a number of characteristics such as scheduling an appointment, providing consultation away from the desk, personal attention, and working with more complex user questions. At the same time, research consultation is considered as a form of information literacy instruction.

A study determined how students use and perceive one-on-one research consultations (Flynn, 2021). The results show that research consultation is a way for students to revise procedures and research concepts to implement it in their study assignments. Another study of students' experiences with one-on-one consultations revealed the importance of individual attention from a librarian, as well as the expertise provided, the appropriate environment, and student involvement (Rogers & Carrier, 2017). It also mentioned the need to promote reference consultations due to the lack of awareness of this type of service.

Other benefits of research consultations were discussed in Watts and Mahfood (2015). Although group instruction is considered to be less time-consuming and most cost-efficient, the research shows many positive outcomes from the one-on-one consultation and the improvement of information literacy skills that could be used by a student in the future. The authors argued that after consultations, students were better informed about library resources and felt more confident working with professional literature. The study refers to the principles of andragogy, where the learning pro-

cess for the adult should be related to the actual problem with immediate application. The usefulness of the research consultation is also supported by changes in reference services with declining desk use, and it has become efficient from a human resources perspective (Bradley et al., 2020). Another researcher (Faix, 2014) argued that research consultations are critical for freshman students who can be overwhelmed by the amount of resources.

There have been several attempts in the literature to create a categorization system for reference services to improve library analytics. Katz (2002), in his seminal work, proposed to analyze reference questions by counting the number of questions asked and by the time taken to answer the questions. Two approaches to categorizing reference transactions were introduced. The first was based on the user's knowledge of specific sources needed to satisfy the information need. The second, more drawn categorization, proposes four categories of reference transactions depending on the type of informational resources: directional, ready reference, specific research questions, and research questions. It is necessary to mention that a reference transaction, starting from an easier level, can turn higher due to the understanding of the user's needs.

Dennison (1999) proposed categorizing reference requests based on their complexity (Simple, Medium-difficulty, harder) and channel of request (phone or in-person). The study's purpose was to estimate the time period during which overload increases at a reference desk and suggest staffing optimization by double staffing or using paraprofessionals for easier questions.

Based on operational statistics from the U.S. health science colleges and libraries, Warner (2001) suggested using a resource- and skill-based approach and proposed four levels of reference service complexity, including nonresource-based, skill-based, strategy-based services, and a consultation. He emphasized the time-consuming nature of consultation, describing it as an activity that requires extensive preparation and the use of research recommendations. The paper presents two ways of organizing the reference services. "Single point of services" means that both the circulation and reference services are provided at one central point so that a user does not have to guess the right person to ask a question. The disadvantage of this approach is either double staffing with both the technical and reference librarians or the use of professional staff to handle all income requests. The second approach, the "triage model", is based on assigning requests by subject and level of complexity to librarians with different levels of experience and expertise. Warner (2001) also argued that the reference professional's time can be viewed as a commodity that needs to be allocated efficiently.

The Warner model has also been adopted in a branch of a public library, where it has shown satisfactory results in evaluating the effectiveness of services. The tiered model has demonstrated a good level of integration between the different staff (from students and assistants to librarians). However, the issue of staff evaluation has been a challenge (Meserve et al., 2009).

The comparison of Katz's and Warner's categorization systems was conducted in a library at the University of South Florida St. Petersburg. The authors of the study argued that implementing an appropriate system for categorizing users' questions can improve the relevance of reference services. Due to the fact that Katz's approach is more resource-oriented and does not focus on increasing the amount of electronic resources, Warner's system also seemed more appropriate due to its skills-based focus (Henry & Neville, 2008).

Bella Karr Gerlich and colleagues proposed a six-point qualitative READ (Reference Effort Assessment Data) Scale in 2007 (Gerlich & Berard, 2007), which was validated a few years later in 14 American academic libraries (Gerlich & Berard, 2010). The READ Scale "emphasizes effort, recognizes time dedicated to the transaction, and highlights the knowledge skills used by the librarian at the time the reference transaction occurs" (Gerlich & Berard, 2007). Implementing the READ Scale involves estimating the average time for each level of reference transaction. However, the calculations reported in the validation study do not take into account the additional time spent interacting with users; therefore, the estimate might be biased towards lower values (Gerlich & Berard, 2010).

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The READ Scale has been implemented in several research studies investigating reference services in academic libraries. In a study conducted at the Washington University Library, the READ Scale was used to uncover the patterns of use of virtual reference services (Belanger et al., 2016). The results indicated a wide variation in the reference services provided to users, with more complex responses provided to undergraduate students. The study discussed the READ Scale, which was recognized as suitable mainly for in-person reference services and perhaps for an older model of services based on the use of print resources. Another study (Ward & Jacoby, 2018) used the READ scale to evaluate the referral gap in different levels of services.

Compared to the widespread use of the READ Scale in the academic library environment in the United States, there is limited evidence of its implementation in the European context. The Library of Psychology at the University of Turin used the READ Scale to investigate the usefulness of semi-automatic categorization of user requests (Bungaro et al., 2017).

The category of questions and the use of resources were considered appropriate indicators to determine staffing for different levels of complexity of reference services (Ryan, 2008). Ryan proposed to distinguish between directional, technology, and lookup questions answered by nonprofessionals, reference questions using a few resources, and the more comprehensive reference questions answered primarily by librarians. However, critics of this study point out that little attention was paid to the type of resources used (Merkley, 2009). A study by Ryan (2008) also proves the cost inefficiency of the traditional reference desk in terms of salary costs, number of information resources, and complexity of requests.

A useful comparison of the different categorization approaches (Katz's, Warner's, READ Scale, etc.) with attention to the professional level of the staff was presented by Maloney and Kemp (2015). They proposed the use of three staff levels: nonprofessional, generalist, and librarian, and discussed the optimization in human resource management. The study found that the increasing number of questions asked by students via chat was associated with higher complexity, often related to research questions. The authors suggested that the triage model does not fit enough the reality when the nonprofessional staff needs to increase their professional level to answer the more complex questions.

The standard of competence of the reference librarian is also discussed in the literature. Since the increasing complexity of reference consultation requires a higher standard, the study by Quinn (1994) examines the characteristics of librarians that make them great specialists. Three dimensions were identified: attitude, professional skills, and interpersonal skills. In each of these categories, a list of applicable personal and professional characteristics was found. The study also reports that, regardless of the importance of attitude, the most important things for the reference librarian are skills that the person can acquire through training.

A study by Zaugg (2021) identifies and validates the competency map of a subject librarian based on a survey of librarians and students. The list of 22 competencies can be used for staff training to ensure high quality one-on-one consultations. It should be noted that in the case of research consultation, there are special requirements for a librarian, such as relevant subject expertise, knowledge of the curriculum, the thesis or the article specifics, etc. (Maloney & Kemp, 2015; Rogers & Carrier, 2017).

Individual, research and highly complex consultations consume many librarian hours, and the impact of these services is difficult to study. Fournier and Sikora (2015) attempt to answer the question of how libraries evaluate the consultation services and the methods they use to do so. One of the most popular approaches is the usage statistics, which provide an overview of the number of users and librarian time spent on consultations as well as the most common topics. This approach allows management to modify the services based on data-driven decision making. Another popular approach is user surveys and users' feedback. More advanced techniques, such as control group experiments, are rarely used.

The study of Canadian academic libraries found that one-on-one research consultations are most

commonly requested by students in the health sciences, medicine, arts and humanities (Fournier & Sikora, 2017). On average, the consultation is scheduled as a one-hour appointment, and a librarian requires additional time for preparation. Follow-up appointments are rarely used. Only a small proportion of libraries use the statistics for access to their reference services, and other qualitative assessments are not applicable at all.

Following the literature review, the purpose of this study is to examine one-on-one reference consultations for undergraduate and graduate students at the Czech National Library of Technology and to evaluate the time consumption, intensity, and variation of using information resources for services with different levels of complexity.

2. METHODS

The Czech National Library of Technology (NTK) is a public library as well as an academic library. Library services are available to everyone, and most of them are free or provided for a small fee. In addition, NTK also serves as an institutional library for the University of Chemistry and Technology Prague and the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences. NTK provides access to the print and electronic STEM (Science, Technology, Engineering, and Math) collection and offers more than 1,300 study places (NTK, 2023).

NTK's services have come a long way from the traditional Czech academic library concept desk reference services to a user-centered approach that reflects modern trends, utilizes close relationships with stakeholders, and changes the mindset of the entire library in the spirit of the motto "The library is a service" (NTK, 2023; Skenderija et al., 2017). As of August 2024, the Information Support Team consists of 17 professionals and 15 full-time equivalents; due to the different fields of study, the expertise of the team members covers a wide range of subjects from STEM and HSS (Humanities and Social Sciences). Although NTK's focus is STEM, user demand has led NTK to expand the scope of reference services to include HSS areas. As a public and academic library, NTK has been providing traditional single-point desk services during assistance hours. Although questions are answered on the spot, there are advanced reference services and one-on-one consultations provided by the Information Support Team outside the desk that require much more effort and resources.

In 2019, in response to the need to collect more advanced statistics, a Customer Relationship Management system (CRM) was implemented in NTK (Chodounská & Ryzhkov, 2019). The dataset for the study was retrieved from the NTK CRM system. Because the CRM system collects quantitative and qualitative data on consultations and users' personal data, the research team examined only anonymized quantitative data describing the characteristics of consultations such as used resources, type of assignment, etc. (see Appendix, Table A1). The collection of 671 consultations from January 2017 to July 2024 includes records of consultations provided by the NTK librarians to undergraduate and graduate students.

A comprehensive approach was applied to the analysis of quantitative data. First, descriptive statistics and frequency distributions were used to examine consultations with different levels of complexity and summarize the use of information resources in the consultations. Additionally, Spearman's correlation analysis was performed to investigate possible relationships between complexity and time for the correlation test and descriptive statistics for time variables. For the test, the variables were categorized into intervals, and the test was conducted for two ordinal variables. All statistical analysis was performed using IBM SPSS Statistics version 29.0.0.0 and Excel spreadsheets.

3. RESULTS

To analyze reference consultations by complexity level, NTK reference services were classified according to the READ Scale (see Table 1), with consultations ranging from grades 3 to 6. "Very Advanced Consultation" (grade 6) primarily serves doctoral candidates and researchers, while consultations for undergraduate and graduate students correspond to levels 3-5, covering "Simple Consultation" to "High Difficulty Consultation" in NTK's classification.

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Table 1. READ Scale and NTK reference service complexity

READ Scale	NTK Reference Service Complexity
1	Desk Query (shorter than 5 min): Simple questions about navigation, using the library catalog and library services, that are answered on the spot, mostly without using additional resources.
2	Desk Query (longer than 5 min): Questions about using the library catalog and library services. The answer/solution may require more time and help from other librarians/specialists.
3	Simple Consultation: Simple one-to-one consultations, for example, "Where to find printed books in Czech for a bachelor thesis" or "How to cite a common source [book, article, chapter]?"
4	Medium Difficulty Consultation: Intermediate one-on-one consultations involving discussion of the user's problem, demonstration of advanced search forms, help with citing atypical sources or help with formatting the paper.
5	High Difficulty Consultation: Very advanced one-on-one consultation with detailed user guidance and assistance in creating highly advanced search queries and selecting and evaluating specific sources. The research question can also be discussed.
6	Very Advanced Consultation: Highly specialized one-on-one consultation on academic writing, publishing in peer-reviewed journals, on writing a grant application, etc.

The research dataset contains records of 671 consultations from January 2017 to July 2024. The annual number of consultations remained steady until 2023 when the increasing number of consultations (double compared to 2017) was caused by intensive promotion. As shown in Figure 1, the number of simple consultations has been increasing, whereas medium-difficulty consultations decreased until late 2020. Undergraduate students generally request simpler consultations more frequently than graduate ones; however, more than 50% of total consultations for undergraduate students are in the medium difficulty category (see Figure 2).

Most consultations were conducted in person (59.2%) or through online meetings using various virtual conferencing platforms (24.7%). There were 14.3% of consultations by email and less than 2% for chat or telephone consultations together. Students are more often asked for help with bachelor's (60.2%) or master's (28.3%) theses. The third most popular type of assignment is semester projects (5.5%). In addition to the above, there are other types of assignments, such as presentation, project application, articles, etc. However, the frequency of these assignments is really limited.

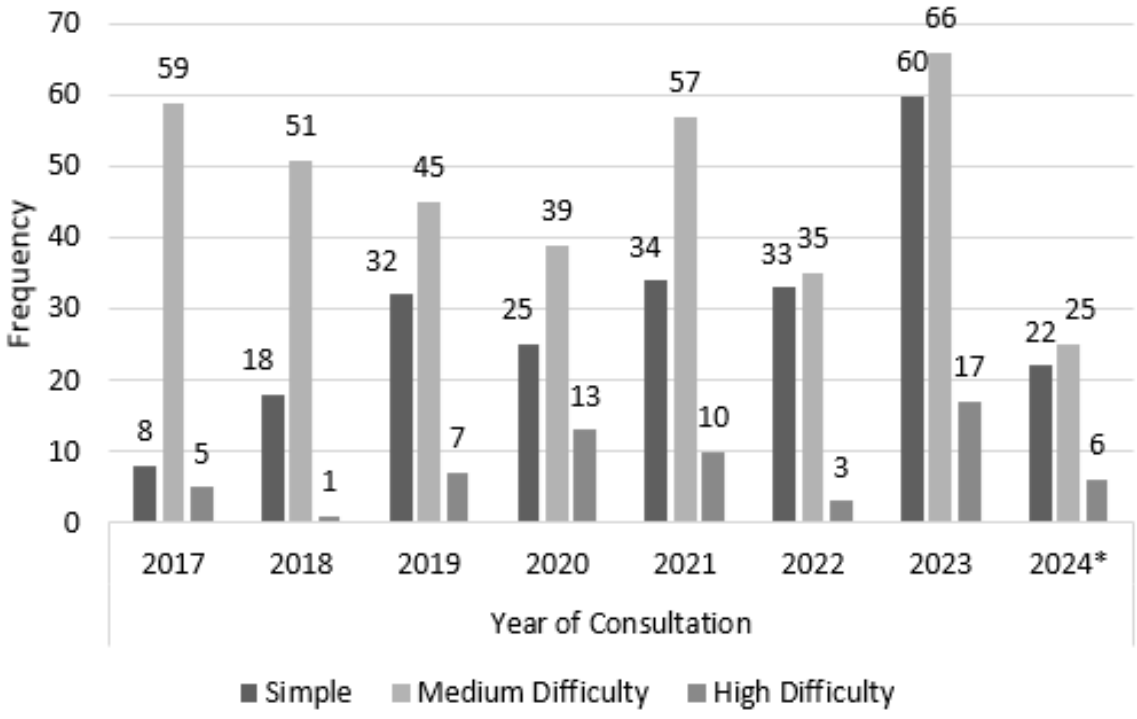

Figure 1. Number of consultations with different complexities per year

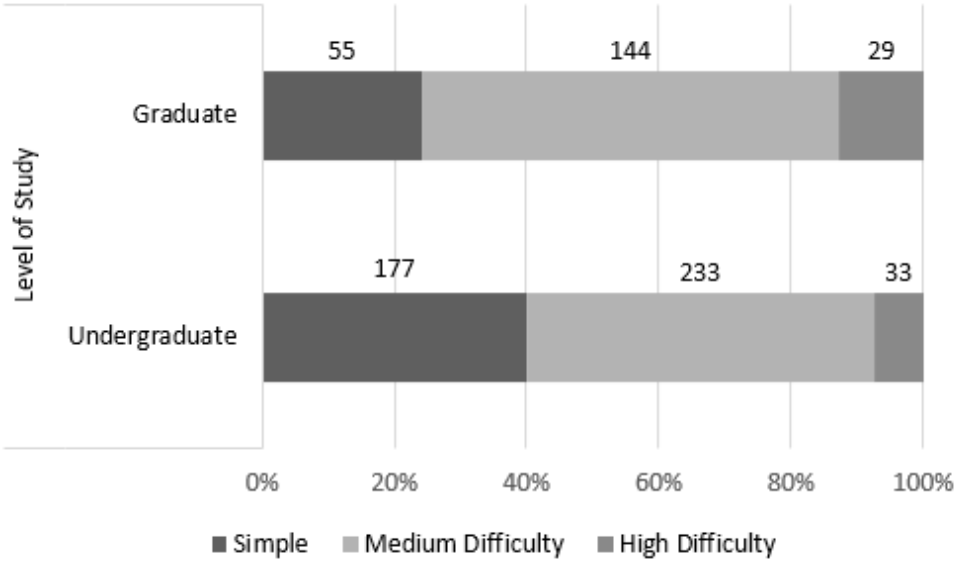

Figure 2. Number of consultations with different complexities per level of study

The analysis of areas of help shows what kind of support is provided to users in consultations. It is necessary to mention that the main areas of help (i.e., searching and evaluating information resources, citing and academic writing) are the same for all levels of complexity. All these areas perfectly fit the most popular types of assignment and belong to the traditional information literacy domain. There are also areas that are close to the research domain (research design, research data management), but they are not frequently addressed. The average consultation addresses 2.2 areas of help. It also can be noted that with increasing the complexity of the consultations, the average number of areas of help slowly increases from 1,94 for simple consultations to 2.58 for high difficulty consultations.

Despite the fact that NTK is focused on STEM, there are almost 40% of consultations in HSS (including economics and management that are monitored separately in the CRM statistics). The next group is engineering, including civil, mechanical, electrical, and material engineering (see Appendix A, Table A2). The average consultation addresses 1.2 disciplines.

To analyze the differences in the use of information resources for services with different levels of complexity, a descriptive analysis was carried out (Table 2). It shows the characteristics of consultations and allows us to find both common and specific signs. In all types of consultations, a wide range of information resources is used, from free search tools to paywalled resources, citation and full-text databases, and special research guides created by NTK librarians.

Simple consultations are provided to undergraduate students three times more often than to graduate. It should be noted that librarians used a relatively large number of resources in simple consultations, even when the questions could not be sophisticated. The reason for this can be the efforts of the librarians to introduce the essential search strategy and good practices to beginners and to influence the information behavior of the users for the future. Librarians emphasize the searching tools (e.g., Google Scholar) and the subject and the research guides created by professionals in NTK (e.g., Searching, Citation Management). Full-text resources are used less frequently than in more complex consultations. At the same time, in 10.3% of simple consultations, users are getting in touch with citation databases (Web of Science and Scopus).

The medium consultations are the most numerous, and the undergraduate students are still the most frequent users of them (61.8%). In terms of the information resources, the consultations of medium difficulty are close to the simple ones. However, there is a slight increase in the use of full-text resources and their diversity. The searching tools

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and the theses repositories are used more intensively than in simple consultations. Medium difficulty consultations can be reported to deal with more complex inquiries that require good orientation in information resources and the ability to decompose a student's question into specific issues.

The smaller group of the high difficulty consultations is characterized by the broadest scope of help. Both types of users, undergraduate and graduate, use these consultations in a close proportion. Regarding the information resources, the high difficulty consultations use less resources than the less difficult consultations. An exception to this is the increasing use of full text resources. It can be evaluated that librarians still need to be familiar with specialized information resources; however, there is another knowledge and skill base

Table 2. Descriptive analysis of the consultation by complexity

Characteristics		Consultation Complexity		
		Simple	**Medium Difficulty**	**High Difficulty**
Consultations	Total number	232	377	62
Consultation by level of study	Undergraduate, number and % of total number	177 (76.3%)	233 (61.8%)	33 (53.2%)
	Graduate, number and % of total number	55 (23.7%)	144 (38.2%)	29 (46.8%)
Area of Help	Average number of areas of help in one consultation	1.94	2.28	2.58
Citation Databased	Number of consultations (% of total consultation)	24 (10.3%)	25 (6.6%)	3 (4.8%)
	Average number of used citation databases	1.33	1.24	1.33
	Most used citation databases (number of consultation)	Web of Science (15), Scopus (14)	Web of Science (27), Scopus (7)	Web of Science (2), Scopus (2)
Full-Text Resources	Number of consultations (% of total consultation)	45 (19.4%)	98 (26.0%)	17 (27.4 %)
	Average number of used full-text resources	1.91	2.28	3.88
	Most used full-text resources (number of consultation)	ProQuest (20), EBSCOhost (13), ScienceDirect (9)	ProQuest (48), EBSCOhost (46), ScienceDirect (21), SAGE (19), SpringerLink (17)	ProQuest (11), SAGE (10), EBSCOhost (8), Taylor&Francis (7)
Reference Resources	Number of consultations (% of total consultation)	17 (7.3%)	22 (5.8%)	4 (6.5%)
	Average number of used reference resources	1.11	1.09	1.0
	Most used reference resources (number of consultation)	Wikipedia (12), Encyclopedia Britannica (4)	Wikipedia (12), Encyclopedia Britannica (11)	Encyclopedia Britannica (2)
Searching Tools	Number of consultations (% of total consultation)	141 (60.8%)	266 (70.6%)	34 (54.8%)
	Average number of used searching tools	2.37	2.74	2.79
	Most used searching tools (number of consultation)	Google Scholar (103), Library Discovery Tool (84), Google (58)	Google Scholar (203), Library Discovery Tool (160), Library Catalog Searching Tool (122), Google (108)	Google Scholar (23), Library Discovery Tool (22), Library Catalog Searching Tool (16), Google (15)
Subject and Research Guides	Number of consultations (% of total consultation)	94 (40.5%)	135 (35.8%)	14 (22.6%)
	Average number of used subject and research guides	1.86	1.66	1.35
	Most used subject and research guides (number of consultation)	Citation Management (46), Searching (36), Theses (23)	Searching (53), Citation Management (49), Subject Guides (40)	Subject Guides (5), Citation Management (4), Instruction Videos (3)
Theses Repositories	Number of consultations (% of total consultation)	86 (37.1%)	190 (50.4%)	28 (45.2 %)
	Average number of used theses repositories	1.38	1.49	1.5
	Most used theses repositories (number of consultation)	Theses.cz (69), Repositories of the Czech universities (39)	Theses.cz (157), Repositories of the Czech universities (97)	Theses.cz (25), Repositories of the Czech universities (12)

that needs to provide this kind of support. For example, understanding students' assignments and research questions is crucial to identifying the related information literacy issues that need to be addressed during consultations.

To address the issue of time spent on consulting services, several statistical analyses were conducted. First, descriptive statistics provide an overview of the differences between the time taken to prepare and deliver the consultations. The values for both the preparation and the consultation time are very varied. Table 3 compares the time variables for the entire dataset and for each complexity level. The average preparation time shows significant variety for all complexity levels and the whole dataset. The preparation time increases with increasing complexity. There is also large variation, with simple consultations having the largest coefficient of variation. The consultation time is a more standardized variable because in-person consultation (presence and virtual), there is a recommended time frame of one hour (which can be shorter or longer depending on the particular consultation). Total time can be used mainly to estimate human resource needs and plan librarians' workload.

The correlation test was used to verify the significance of the relationship between the time spent and the complexity of the consultations. The results (Table 4) show that there is a significant correlation between complexity and all the time variables. Therefore, the analysis shows that as the complexity of consultations increases, more time spent by a librarian should be expected. Total time has the highest correlation strength, supporting the idea of measuring total time spent.

Table 4. Test results for correlation between complexity and time variables

Results	Preparation time	Consultation time	Total time
p-value	< 0.001	< 0.001	< 0.001
Spearman Correlation Coefficient	0.276	0.262	0.344

4. DISCUSSION

To the best of the available knowledge, the reported research contributes to the study of the complexity of reference services in academic libraries in terms of time and information resources utilized. In accordance with the review of existing complexity frameworks for reference services, the READ Scale (Gerlich & Berard, 2007) was chosen. The presented NTK Reference Service Complexity Grade is in good agreement with the READ Scale. Current research shows the possibility of using this framework to implement an effective reference service model and receive valuable statistics for a public academic library.

It should be noted that the determination of the specific type of complexity, both in the READ scale and the NTK Reference Service grade, is

Table 3. Time variables descriptive statistics

Statistics	All consultations	Consultation Complexity		
		Simple	Medium Difficulty	High Difficulty
Preparation time Minimum, minutes	1	1	1	1
Preparation time Maximum, minutes	145	120	140	145
Preparation time Mean, minutes	69.06	55.00	69.55	118.71
Preparation time Standard Deviation	63.651	55.479	61.437	79.496
Preparation time Coefficient of Variation	92%	101%	88%	67%
Consultation time Minimum, minutes	1	1	1	1
Consultation time Maximum, minutes	480	480	360	360
Consultation time Mean, minutes	57.61	48.99	60.58	71.85
Consultation time Standard Deviation	24.736	25.582	21.305	30.016
Consultation time Coefficient of Variation	43%	52%	35%	42%
Total time Minimum, minutes	6	6	30	27
Total time Maximum, minutes	520	520	435	420
Total time Mean, minutes	120.78	96.96	124.38	188.05
Total time Standard Deviation	72.797	65.628	68.065	80.634
Total time Coefficient of Variation	60%	68%	55%	43%

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subjective, dependent, and may be influenced by a librarian's perception and experience. The paper (Gerlich & Berard, 2010) also mentioned librarians who are confused about defining complexity because of their different experiences and subject specialization. The solution might be to use the more precise characteristics of both the requests and the responses to specify the level of complexity.

Since the READ scale is designed from a time-consuming point of view, there are some issues. One of the disadvantages of the READ scale is the lack of a clear definition of tracked time a librarian needs to handle reference transactions. Contrary to the READ scale (Gerlich & Berard, 2010), the present study can provide a comprehensive view of the issue. The time spent on preparation and delivering a consultation was indicated and analyzed, as well as the total time. The approach presented could provide transparent and reliable statistics demonstrating the staff's real workload. The paper of Gerlich and Berard (2010) provides evidence of average time per question for reference transactions with different levels of complexity from the described research test period where all the presented values are smaller than in the current paper. This fact may indicate that previous studies do not account for all the librarian's time spent on consultations, which may lead to inadequate workload planning.

The total time could be used to calculate the cost-efficiency of the reference consultation. Unlike the approach proposed by Ryan (2008), this calculation could be used for the single-desk model and generally for the case when librarians are responsible for various tasks, including consultations. A possible improvement to this approach would be to include time spent on staff training, post-consultation follow-up, or time spent leading the team to manage the process as additional costs to be considered in the cost-effectiveness assessment. However, this approach may require more statistics and consideration of the consultation process in a particular library.

Ward and Jacoby (2018) also provide evidence that as complexity increases, it takes longer for employees to answer user questions. At the same time, librarians have better understanding the information needs of users in more complex requests. These statements refer only to levels "3" and "4" on the READ scale. They are consistent with the results of the present study.

Criticism of the READ scale also includes the issue of a time framework. It has been mentioned that the reference transaction marked as "3" can last from 5 to 20 minutes (Gerlich & Berard, 2010). Respondents to the study on the validity of READ were confused by this fact and suggested that more specific benchmarks should be used. The current study also shows that simple consultations (equivalent to level "3") have the greatest variability in preparation, consultation, and total time. From this perspective, it is possible that the variety of requests, previous experience, and the level of information literacy of the users can explain this variability. The more informed user may need only basic navigation and assistance, whereas the novice may need more detailed explanation and guidance even for a simple request. Similar to the study by Belanger et al. (2016), this study also shows that undergraduate students need a broad range of advising, including all types of complexity. The overview of the areas of help and type of assignment clearly indicates that the consultations on medium and high difficulty levels demonstrate the signs of research consultations.

Current research demonstrates that information resources are required for all the complexity levels. Thus, professional training and continued self-development are crucial for a reference librarian. The quality of reference services is based on both a deeper understanding of the principles of information literacy in general and the applicability and limitations of specific information resources. It could be claimed that the purpose of using the information resources is diverse at different complexity levels. However, for an academic library, the use of information resources during a reference consultation can be an effective tool for promoting and building a positive user experience.

This study contains several limitations. The main limitation is that the dataset was taken from a single institution with a specific position in the Czech higher education system. The next limitation is the absence of a time-series analysis, which could bring an interesting view of the trends of the consultations.

Future studies could focus on estimating the total costs of the consultation and exploring the relationships of the complexity of consultations with other characteristics such as area of help, discipline of assignment, etc. One of the biggest challenges in a reference consultation study has been understanding the experience of students with consultation and the perceived value of this type of reference service from the user's point of view.

CONCLUSION

The purpose of this study was to assess reference consultations for undergraduate and graduate students by analyzing time consumption, as well as using information resources, across consultations with differing complexity levels. To achieve the research purpose, the data set containing 671 consultations provided at NTK from January 2017 to July 2024 was analyzed. The READ scale was used to compare the levels of complexity used in one-on-one reference services in an academic library. The findings have demonstrated that information resources are relevant for all levels of complexity. However, the importance and utilization of information resources can differ. While a simple consultation is characterized by a wider variety of information resources and provides the essentials of information literacy, a more complex consultation has been found to require a more complex approach, an understanding of specific databases, and appropriate research or subject expertise on the part of the librarian. The analysis examined time spent on both preparation and conducting consultations, revealing a significant correlation between time investment and complexity (ranging from 0.262 to 0.344). Additionally, simple consultations showed the highest variation. The current study highlights the aspects of resources of the consultation and suggests that this approach could help to estimate total consultation costs more accurately. First, the study indicates the need for librarians to improve their professional skills. Even in the case of simple consultation, the librarian should be well informed in various aspects of information use and research assignments. At the same time, reference consultation could be an efficient tool of information resources promotion and build strong positive user experience. Due to the increasing time consumption, the library management should monitor the real time for consultation transactions to evaluate the cost-efficiency of services and improve the staff workload.

AUTHOR CONTRIBUTIONS

Conceptualization: Naděžda Firsová, Jana Hinke, Luboš Smutka.
Data curation: Naděžda Firsová.
Formal analysis: Naděžda Firsová, Jana Hinke, Luboš Smutka.
Investigation: Naděžda Firsová.
Methodology: Naděžda Firsová, Jana Hinke, Luboš Smutka
Validation: Jana Hinke.
Visualization: Jana Hinke.
Resources: Naděžda Firsová.
Software: Naděžda Firsová.
Supervision: Luboš Smutka.
Writing – original draft: Naděžda Firsová, Jana Hinke, Luboš Smutka.
Writing – review & editing: Naděžda Firsová, Jana Hinke, Luboš Smutka.

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APPENDIX A

Table A1. Definitions of consultation characteristics used in the study

Variable	Values/Labels	Type of Scale
Consultation Year	2017–2024	Ordinal
Level of Study	Undergraduate; Graduate	Ordinal
Complexity of Consultation	Simple; Medium Difficulty; High Difficulty	Ordinal
Consultation Time, min	1-145	Numeric
Preparation Time, min	1-480	Numeric
Total Time, min	6-520	Numeric
Channel of Consultation	Email; Chat; In-person; Phone; Virtual Conferencing Platform	Nominal
Type of Assignment	Article; Career Development; Presentation; Project Application; Semester Project; Teaching; Thesis (Bachelor); Thesis (Master); Thesis (Ph.D.); Other; N/A	Nominal
Area of Help* (set of dichotomous variables)	Searching and Evaluating; Citing; Academic Writing; Editing; Research Data Management; Document Delivery; Access to e-Resources; Language Support; Software Support; Research Design; Other	Binary
Discipline of Assignment* (set of dichotomous variables)	Humanities and Social Sciences; Environmental Science; Transportation; Computer Science; Biology; Architecture; Civil Engineering; Electrical Engineering; Mechanical Engineering; Medicine; Law; Math; Economics; Management; Agriculture; Chemistry; Physics; Material Engineering; Other, N/A	Binary
Citation databases* (set of dichotomous variables)	Web of Science; Scopus; Journal Citation Report; Ulrichsweb; Science Citation; Scientific Citation	Binary
Full-Text Resources* (set of dichotomous variables)	EBSCOhost; ProQuest; SAGE; Emerald Premiere; Taylor & Francis; Wiley; Science Direct; Springer Link; IEEE/IET Library; Academic Search, Cambridge Journals; AIP; JSTOR; Science; Nature Complete; Business Source; IHS Engineering Workbench; SAE Technical; IOPscience; ASCE Library; RSC Gold; Oxford Journals; ICE Engineering	Binary
References Resources* (set of dichotomous variables)	Encyclopedia Britannica; Wikipedia; Access Sciences; Oxford Dictionary	Binary
Search tools* (set of dichotomous variables)	Google; Google Scholar; NTK Library Print Catalog Searching Tool; NTK Library Summon; NTK Library eBooks Searching Tool; NTK Library eJournals Searching Tool; WorldCat; Knihovny.cz; Summons of Other Czech Academic Libraries; Union Catalog of the Czech Republic	Binary
Subject and Research Guides* (set of dichotomous variables)	Subject Guides by Disciplines; Searching; Citation Management; Gray Literature; Instruction Videos; Theses; eBooks; CRAAP filter; Standards; Patents; Google Scholar; How to start writing; Open Access; STEMskiller; Searching Library Resources	Binary
Thesis Repositories* (set of dichotomous variables)	Theses.cz; ProQuest Thesis; Repositories of different universities	Binary

Note: * Multiple choice characteristics of consultation.

Comments to Table A1:

1. The "Complexity of Consultation" is determined by the librarian who provides the consultation and is based on the NTK Reference Service.

2. The "Total Time" variable is derived from the sum of the "Consultation Time" and "Preparation Time."

3. Some of the consultations' characteristics are multiple-choice. They were transformed into sets of dichotomous variables with values 0 ("False") and 1 ("True").

4. The variable "Type of Assignment" includes some values that are not traditional for students (e.g., "Article" or "Thesis (Ph.D.)"); however, in some cases, these may occur in the consultation process, such as when a graduate student is preparing to enroll in a Ph.D. program.

5. The "Discipline of Assignment" represents the subject of the assignment or the topic of a thesis. In the case of a multidisciplinary assignment, it can contain multiple values.

6. Predefined lists of citation databases, full-text resources, and reference resources, searching tools show the resources provided by NTK to users or open access resources used in NTK. Other resources may be used during the consultation; however, this information was not included in this analysis.

7. The "Subject and Research Guides" list contains the online information tools created by the Information Support Team and made available unconditionally to everyone.

Table A2. Absolute and relative frequencies of "Discipline of Assignment"

Discipline of Assignment	Number of consultations	%
Humanities and Social Sciences	161	19.6%
Economics and Management	157	19.1%
Engineering (Civil, Electrical, Mechanical, Material)	100	12.2%
Environmental Science	52	6.3%
Computer Science	44	5.4%
Chemistry	38	4.6%
Agriculture	31	3.8%
Medicine	31	3.8%
Law	24	2.9%
Architecture	23	2.8%
Biology	20	2.4%
Physics and Math	17	2.1%
Transportation	13	1.6%
Other	84	10.2%
N/A	26	3.2%
Sum	821	100.0%

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