A Scoping Review of Collaborative Information Behavior: Definitions and Collaborative Tools

Abidemi Atolagbe-Olaoye[a] and Hsia-Ching Chang[a]

[a]University of North Texas, USA

AbidemiAtolagbe-Olaoye@my.unt.edu, Hsia-Ching.Chang@unt.edu

ABSTRACT

Many researchers have mischaracterized collaborative information behavior (CIB) with its sub-processes, including collaborative information seeking (CIS) and collaborative information retrieval (CIR). To learn about the most prominent CIB definitions, the phases involved in the CIB process, and the various collaboration tools that facilitate CIB, we sifted through a wide range of LIS research papers. Using a scoping review to correspond with the research questions, we conducted several iterations to exclude irrelevant studies while concurrently including pertinent ones. The "C5 model of collaboration" developed by Shah provides a framework for coding our data during content analysis and concept mapping. Our findings indicate that CIB has no generally adopted definition. Additionally, traditional workplace tools and technologies are the collaborative tools utilized for various collaborative activities. More CIB research is needed in the information science field to stay ahead of the rapid growth of collaborative AI technologies, particularly those that foster human-AI collaborations.

ALISE RESEARCH TAXONOMY TOPICS

information needs; information seeking; information use.

AUTHOR KEYWORDS

collaboration; collaborative activities; collaborative information behavior; collaborative tools; scoping review.

INTRODUCTION

Several studies recognize and build upon the work of Karamuftuoglu (1998), a pioneer in examining collaborative nature of information behavior (IB), specifically information seeking. Studies in this area have inspired subsequent research on CIS, CIR, collaborative search, collaborative sensemaking, and other collaborative activities.

Most researchers concurred that collaborative information behavior (CIB) is an overarching concept encompassing collaborative activities which engage with information, focusing primarily on collaborative information seeking and collaborative information retrieval (Karunakaran et al., 2013; Widén & Hansen, 2012). Yet, no unified definition exists for CIB. In some cases, there is a misperception about the scope of CIB.

Another focal point of this study is the investigation of collaborative tools supporting CIB. Despite the efforts of a few scholars in the past, this aspect is under-researched. For instance, González-Ibáñez & Shah (2011) developed Coagmento as a tool used to support some laboratory and field studies; however, its application in organizational or any professional context is unknown. Same for similar tools such as ARIADNE (Reddy et al., 2008), SearchTogether & WeSearch (Morris et al., 2010), etc. With the emergence of novel collaborative tools and technologies such as ChatGPT, it is imperative for information professionals to explore the collaborative tools that facilitate CIB, with an emphasis on those that effectively support entire CIB process outside of laboratory settings.

LITERATURE REVIEW

Collaboration is "the most advanced form of activity undertaken jointly by a group" leading to problem solving through participant's contribution (Reddy & Spence, 2008; Shah, 2010). Reddy and Jansen (2008) state that information needs trigger collaborative information seeking activities, causing team members to find needed information by searching, interpreting, contextualizing, assessing, and retrieving the information together. Over the years, researchers have been exploring various aspects of CIB. Examples include collaborative search (Morris et al. 2010), collaborative information seeking (CIS) (Leeder & Shah, 2016), collaborative information retrieval (CIR) (Fidel et al., 2004), information sharing, collaborative sensemaking, information use, and other collaborative activities (Karunakaran et al., 2013). Figure 1 demonstrates the CIB related research topics covered in previous studies. While the prior research pays more attention on CIS and CIR, it will be beneficial to broaden the scope to CIB to better understand the impact of CIS or CIR on information sharing and information use in practice.

Figure 1

The sub-processes of CIB covered in previous studies.

Collaborative Information Behavior

Collaborative information behavior is a nexus of two concepts: (1) collaboration and (2) information behavior, an information science phenomenon. Irnazarow et al. (2019) and many other studies agree that information behavior is an individual phenomenon that starts when an actor needs information; consequently, information needs trigger information behavior, such as information seeking, information sharing, and information use. Sapa (2020; 2022) describes CIB in the context of a team's engagement in physical tasks and the use of necessary skills in collaborative problem-solving. Sapa's (2020) study echoes Karunakaran & colleagues' statement regarding the mischaracterization of CIB with the use of terms such as CIS, CIR, collaborative search etc. With more than two decades of CIB research and studies spanning various contexts, researchers still struggle in adopting a general definition for the phenomenon.

Collaborative Tools

Du Preez (2019) states that CIB "only manifests in environments requiring teamwork, group learning, knowledge sharing, as well as budget and time constraints." Another study states that CIB helps to "identify information for accomplishing a task or solving a problem" (Talja & Hansen, 2006). It is important to consider the contexts of CIB and look into the tools that support CIB, especially in the post-COVID-19 environment that has changed how teams and organizations collaborate to accomplish their goals. Therefore, this study aims to answer the following research questions:
1. Which CIB definitions are most frequently adopted in CIB studies?
2. What CIB sub-processes are identified in CIB research?
3. What collaborative tools are utilized to support CIB?

RESEARCH METHODS

Colquhoun et al. (2014) define scoping review as "a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge." This study uses the PRISMA Extension for Scoping Reviews (PRISMA-ScR) developed by Tricco et al. (2018) as the protocol for the scoping review.

Data Collection

We used only CIB-specific studies to determine the extent and variety of CIB activities presented in CIB research. Papers focusing on other CIB areas such as CIS, CIR, collaborative web search, etc. are not part of the sample, since CIB was the specific research area targeted. Two strings, "collaborative information behavior" OR "collaborative information behaviour" were used in the query to be sure the hits include both variations of English grammar since the focus was on papers written in English language. Other languages were excluded. Other criteria considered for inclusion and exclusion are non-restriction on publication year, journals, conference papers, book chapters, & dissertations. We did not use "collaborative tool" as a search string in the present study because our goal is to focus solely on CIB papers and discover what tools and technologies discussed in them. All the references were reviewed to see possibility of snowballing to other relevant CIB papers. The following databases were searched – Information Science & Technology Abstract (ISTA), Library and Information Science Abstracts (LISA), Library, Information Science & Technology Abstracts (LISTA), ScienceDirect, Web of Science, and Google Scholar.

Search results

Table 1
Search results

Databases	Papers retrieved	Papers after iteration 1	Papers after iteration 2	Papers after iteration 3	Final Selection
ISTA (EBSCOhost)	16	16	9	9	1
LISA (ProQuest)	21	20	20	20	17
LISTA (EBSCOhost)	37	33	19	19	4
ScienceDirect	31	31	5	5	1
Web of Science	34	31	19	19	0
ProQuest Dissertations*	85	83	6	12	5
Google Scholar*	142	120	24	87	13
TOTAL	**366**	**334**	**102**	**171**	**41**

*69 snowball papers were retrieved by reviewing all the references of the papers remaining after "iteration 2." At the end of "iteration 2" exercise, 63 papers were added to Google Scholar since most of them were discovered through Google search while the remaining six were added to ProQuest Dissertation since they are PhD dissertation papers. "Iteration 3" is the process of excluding duplicate papers and those that are not relevant to the scope of this study. It also updated the snowball papers to the sample at that stage.

Figure 2
Flowchart of the literature search and selection process
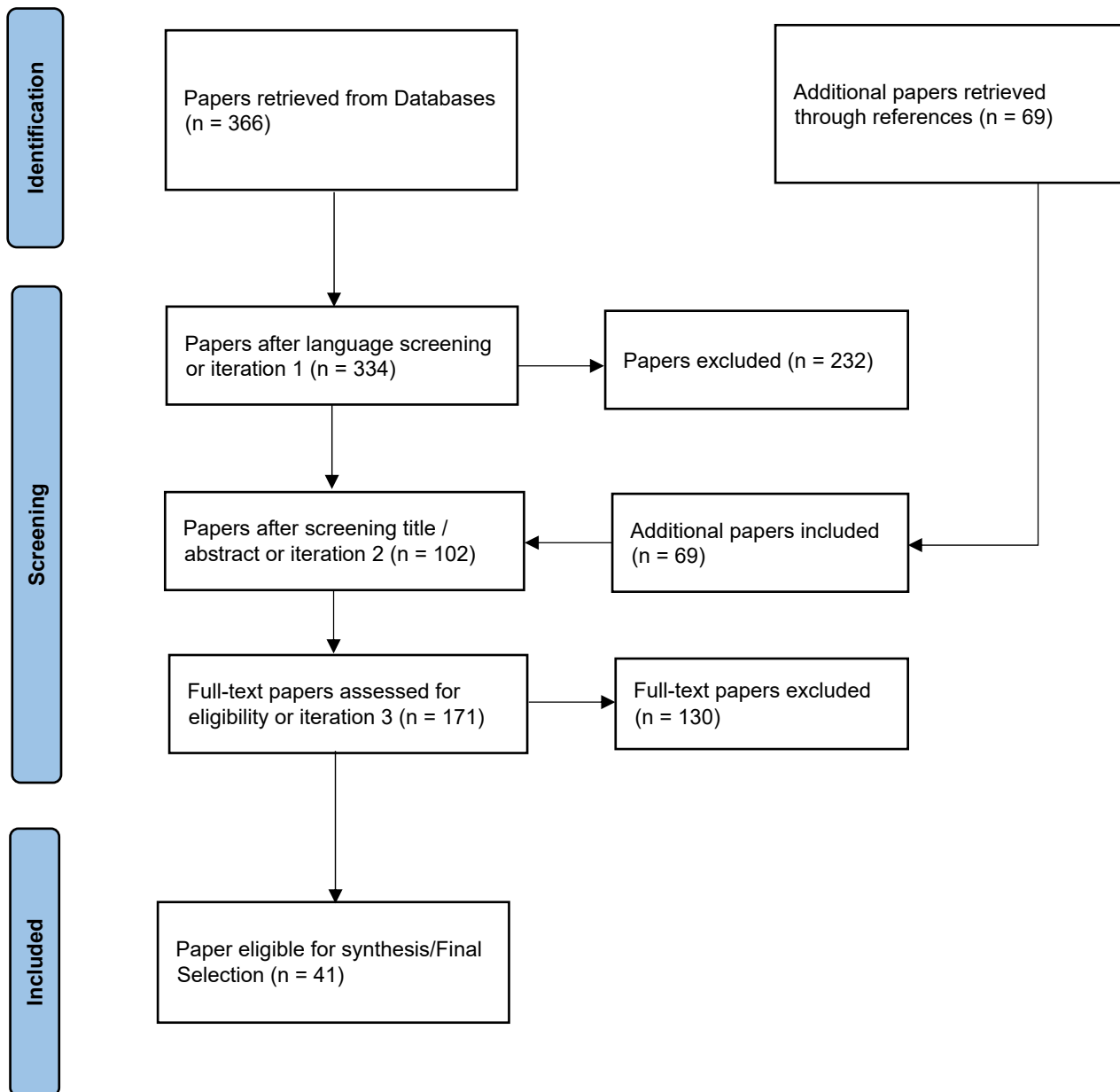
DATA ANALYSIS and RESULTS

We conducted content analysis and concept mapping to obtain the results presented below.

CIB Definitions

Not all CIB studies provided definitions. Around 50% of the CIB studies included a definition for CIB. Table 2 summarizes the definition sources and indicates those originally defined by the authors and the ones that were referenced by other authors.

Table 2
Summary of CIB definition sources

| Author(s) of the Definition	Referenced	Count	Paper(s) citing the definition
Karunakaran et al. (2010)	Yes	1	Zeinali & Mahdavi (2014)
Karunakaran et al. (2013)	Yes	7	Krishna & Paul (2020); Ye et al. (2021); Hernández-Pérez (2017); khatamian Far (2019); Sapa (2022); Buasuwan (2021); Khatamian Far (2020)
Champion et al. (2017)	No	N/A	
Saleh (2012)	Yes	3	Ndumbaro & Mutula (2017; 2019); Khatamian Far (2020)
Du Preez (2015)	No	N/A	
Sapa (2020)	Yes	1	Sapa (2022)
Talja & Hansen (2006)	Yes	4	Saleh (2011; 2012); Poteri (2007); Khatamian Far (2020)
Hyldegård (2006)	Yes	1	Khatamian Far (2020)

The above table shows that 13 distinct studies referenced the original definitions by several authors. The most cited work is that of Karunakaran et al. (2013) that proposed a CIB model in an organization context. They defined CIB as "the totality of behaviour exhibited when people work together to (a) understand and formulate the information need through the help of shared representations; (b) seek the needed information through a cyclical process of searching, retrieving, and sharing; and (c) put the found information to use (p. 2438)." The definitions by Talja and Hansen (2006) and Saleh (2012) have four and three references respectively. Talja and Hansen (2006) describes CIB as "an activity where two or more actors communicate to identify information for accomplishing a task or solving a problem...[it] includes processes of problem identification, analysis of information need, query formulation, retrieval interactions, evaluation,

presentation of results, and applying results to resolve an information problem (p. 114). Adapting Wilson's (2000) view on IB, Saleh (2012) defined CIB as "the totality of human behaviour, when two or more people work together, in relation to sources and channels of information, including both active and passive information seeking and information use" (p. 20).

CIB Sub-Processes

Figure 3 presents a concept map of CIB related concepts, sub-processes, and their relationships.

Figure 3
A Concept Map of CIB
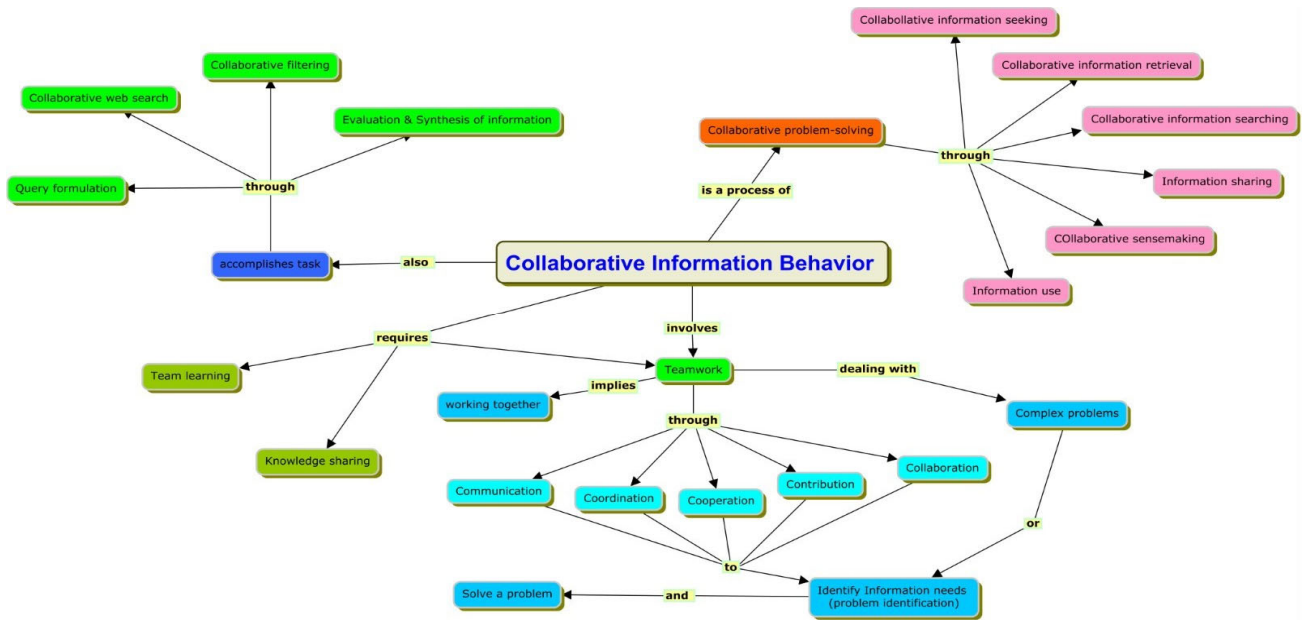
Collaborative Tools in CIB Research

The number of papers that discussed the tools and technologies used to support CIB in the professional settings and laboratory environment is presented in Figure 4. 26 papers (63.4%) discussed tools in professional settings, whereas four papers (9.8%) discussed the tools used in the laboratory setting, typically for experiment purposes among students' group work. 11 papers (26.8%) did not mention any CIB tools.

Figure 4

The number of papers discussing collaborative tools and their contexts
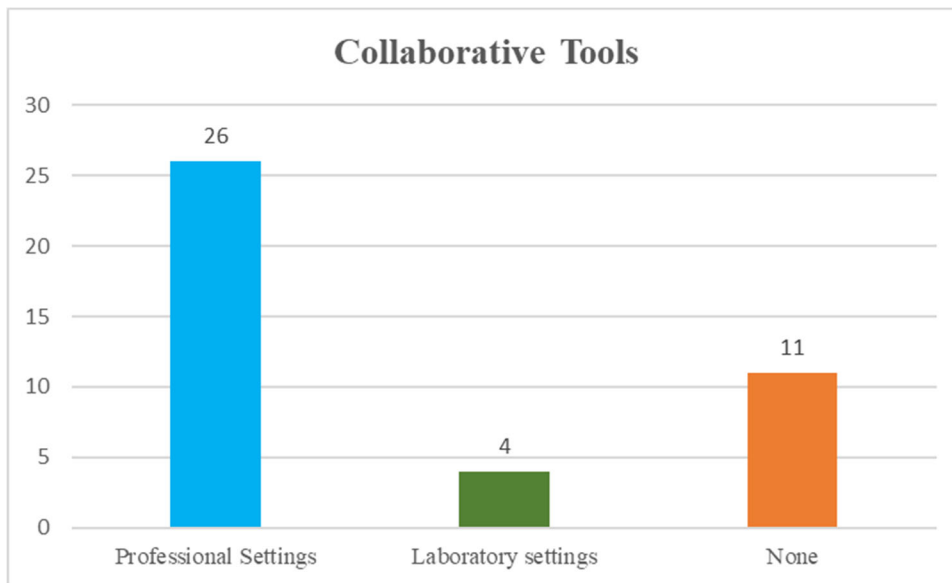
Some tools used in laboratory settings (e.g., ARIADNE, SearchTogether, Coagmento) have not been made public. Therefore, we limit our analysis to the collaborative tools utilized by different user groups in professional settings. Table 5 summarizes the results of our content analysis.

Table 3

CIB Tools in professional settings

CIB sub-process	Collaborative Tools & Technologies	Professional Setting / User Group
CIS	Telephone, The Internet	Healthcare, Engineers, Students, Wikipedia community
CIR	Digital Document & Archiving System, Digital x-ray workstation, Electronic Databases	Healthcare, *Engineers, *Students
Collaborative Search	The Internet (e.g., Google Search, Wiki pages), Electronic Databases	Wikipedia community, Students
Information Evaluation / Information Processing	SPSS, MS Word, Zoho, Diagnostic tools (e.g., HemoCue), Excel Spreadsheet, LabVIEW, Mendeley	*Students, *Healthcare
Information Sharing	Social media (e.g., Facebook, WhatsApp). YouTube, Video Conference (e.g., Skype) Email, Google Docs, Google Calendar, Dropbox, Vital signs monitor, Telephone, VMT Chat, Instant messenger	*Students, *Online groups, *Engineers, *Healthcare
Others (e.g., Identifying information needs, Collaborative problem-solving, Communication)	Wikis, Portals, Online discussion boards, MS PowerPoint, Prezi, Telephone, Google Presentation, Video Conferencing	*Online groups, Students, *Healthcare

*The user group used one or more of the tools listed for the sub-process – not all the listed tools.

DISCUSSION

This review reveals that only eight studies provided authors' original CIB definitions. 13 studies cited at least one of these definitions. Although some literature created their definitions. (e.g., Karunakaran et al., 2013; Saleh, 2012; Talja & Hansen, 2006), multiple researchers continue to use CIB interchangeably with key sub-process like CIS and CIR. For example, Saleh and Large (2011) adopted Hansen and Järvelin (2005) CIR's definition for CIB. Similarly, other researchers adopted the CIR definition by Poltrock et al. (2003) or Foster (2006)'s CIS definition for their CIB research.

As an outcome of our content analysis, Figure 3 shows a concept map depicting the CIB sub-processes, relevant concepts, and their relationships. Additionally, the "C5 model collaboration" (Shah, 2010) manifests itself when teams cope with complex information needs. Although not all the papers addressed all the elements of C5, most of the studies mentioned communication and collaboration which is achieved through teamwork with a common goal.

The review also informs us that 73% of CIB research mentioned the use of several collaborative tools throughout the entire CIB lifecycle. Interestingly, 63% of research looking into collaboration tools used in various professional settings also discussed information sharing tools.

According to a recent report by Outsell, Inc. (2023), collaborative tools (e.g., MS Teams and Slack) have exceeded emails to become the main information sharing tools. In CIB literature, such emerging collaborative tools have not been studied. In addition, none of the publications described what collaborative tools facilitate information use.

Since the COVID-19 pandemic, many organizations and educational institutions have transitioned to remote and hybrid work or learning modes that require fewer face-to-face interactions. More CIB research could advance education in LIS by fostering the development of efficient collaborative tools to address users' information needs, engaging collaborative learning among students, researchers, as well as AI tools, and creating opportunities for interdisciplinary collaborations between LIS and related fields (e.g., Learning Technologies and Information Systems).

CONCLUSION

This study addressed CIB research by including only CIB studies and excluding papers that concentrated solely on its sub-processes such as CIS, CIR, collaborative search, etc. Our search and selection approach, therefore, differs from previous review studies such as Sapa (2022). We discovered that not every CIB study used a definition for CIB, implying that CIB research is still in its early stages and needs more rigorous studies which consider CIB as an umbrella concept for collaborative activities to develop a general definition. With existing definitions and descriptions of collaborative activities from the literature, we were able to identify and map key concepts and sub-processes of CIB with a concept map.

The last research question in this study focused on the collaborative tools that assist CIB. Tables 2 and 3 highlight the preliminary findings of our scoping review. We will further explore this topic in our ongoing research to unveil emerging tools and technologies especially in the post-COVID-19 era and investigate the roles and limitations of the collaborative tools. With the emergence of collaborative AI tools such as ChatGPT, CIB research could explore how the AI tools can support collaborative activities, improve productivity, and meet the information needs of CIB. Future research could also tackle what and how collaborative tools have transformed the CIB in various contexts considering the influence of collaborative AI tools on human-AI collaborations.

SELECTED REFERENCES

Buasuwan, N. (2021). *Social Media and Collaborative Information Behaviour Intergenerational Difference in a Multinational Company Setting.* PhD Thesis, University of Leeds.

Case, D. O. & Given, L. M. (2016). *Looking for information: A survey of research on information seeking, needs, and behavior* (4th ed.). Bingley, U.K.: Emerald.

Champion, C., Affleck, E., Alvarez, G. G., & Kuziemsky, C. (2017). A combined collaborative information behaviour (CIB) and continuity of care framework for modeling complexity in colorectal cancer screening access. In *MEDINFO 2017: Precision Healthcare through Informatics* (pp. 696-699). IOS Press.

Colquhoun, H.L., Levac, D., O'Brien, K.K., Straus, S., Tricco, A.C., Perrier, L., Kastner, M. & Moher, D. (2014). Scoping reviews: time for clarity in definition, methods, and reporting.

Du Preez, M. (2019). Exploring contexts in consulting engineers' collaborative information behaviour. *Journal of Librarianship and Information Science, 51*(3), 643-653.

Du Preez, M. (2015). *The role of social networks in consulting engineers' collaborative information behaviour.* PhD Thesis, University of South Africa.

Far, P.K. (2020). Group cohesion and collaborative information behaviour: An exploration of student experiences of university group work. PhD Thesis, Edith Cowan University.

Far, P. K. (2019). Research together: exploring students' collaborative information behaviour in group work settings.

Fidel, R., Mark Pejtersen, A., Cleal, B., & Bruce, H. (2004). A multidimensional approach to the study of human-information interaction: A case study of collaborative information retrieval. *Journal of the American Society for information Science and Technology, 55*(11), 939-953.

González-Ibáñez, R., & Shah, C. (2011). Coagmento: A system for supporting collaborative information seeking. *proceedings of the American Society for Information Science and Technology, 48*(1), 1-4.

Hansen, P., & Järvelin, K. (2005). Collaborative information retrieval in an information-intensive domain. *Information Process Management 41,* 1101-1119.

Hernández-Pérez, O. (2017). Collaborative information behaviour in completely online groups: exploring the social dimensions of information in virtual environments. *Qualitative and Quantitative Methods in Libraries (QQML),* 4: 775-787.

Hyldegård, J. (2006). Collaborative information behaviour—exploring Kuhlthau's Information Search Process model in a group-based educational setting. *Information processing & management, 42*(1), 276-298.

Irnazarow, A., Allen, D., & McKay, A. (2019, October). Investigating collaborative information behaviours in complex product development work. In *2019 SIG-USE Symposium Paper Presentations.* SIG-USE.

Karamuftuoglu, M. (1998). Collaborative information retrieval: Toward a social informatics view of IR interaction. *Journal of the American Society for Information Science, 49*(12), 1070-1080.

Karunakaran, A., Reddy, M. C., & Spence, P. R. (2013). Toward a model of collaborative information behavior in organizations. Journal of the American Society for Information Science and Technology, 64(12), 2437-2451.

Krishna, B. & Paul, A. (2020). Collaborative information behaviour during epidemics: The case of Nipah outbreak in Southern India. Working papers 367, Indian Institute of Management Kozhikode.

Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. Journal of the American society for information science, 42(5), 361-371.

Leeder, C., & Shah, C. (2016). Collaborative information seeking in student group projects. *Aslib Journal of Information Management*, *68*(5), 526-544.

Morris, M. R., Lombardo, J., & Wigdor, D. (2010, February). WeSearch: supporting collaborative search and sensemaking on a tabletop display. In *Proceedings of the 2010 ACM conference on Computer supported cooperative work* (pp. 401-410).

Ndumbaro, F., & Mutula, S. (2019). Applicability of solitary model of information behavior in students' collaborative learning assignments. *Information and Learning Sciences*, *120*(3/4), 190-207.

Ndumbaro, F., & Mutula, S. M. (2017). Collaborative information behaviour of butterfly farmers in Eastern Usambara Mountains, Tanzania. *Malaysian Journal of Library & Information Science*, *22*(2), 15-29.

Outsell, Inc. (2023). *Information seeking and consumption study report*. Copyright Clearance Center. Retrieved from CCC-RD-2023-Outsell-eBook.pdf.

Poltrock, S., Grudin, J., Dumais, S., Fidel, R., Bruce, H. & Pejtersen, A. M. (2003). Information seeking and sharing in design teams. In *Proceedings of the 2003 international ACM SIGGROUP conference on Supporting group work (GROUP '03)*. New York, NY, USA, 239–247.

Poteri, E. (2007). *Collaborative information behaviour: A case study of two research group*s. Licentiate Thesis, Åbo Akademi University.

Reddy, M. C., & Jansen, B. J. (2008). A model for understanding collaborative information behavior in context: A study of two healthcare teams. *Information Processing & Management*, *44*(1), 256-273.

Reddy, M. C., Jansen, B. J., & Krishnappa, R. (2008). The role of communication in collaborative information searching. *Proceedings of the American Society for Information Science and Technology*, *45*(1), 1-10.

Riley, F. G., & Allen, D. A. (2019). Information spheres: Collaborative information behavior within project teams.

Saleh, N. (2012). *Collaborative information behavior in learning tasks: A study of engineering students*. PhD Thesis, McGill University, Montreal.

Saleh, N. (2011). Collaborative information behaviour of engineering students in a senior design group project: A pilot study. In *2011 ASEE Annual Conference & Exposition* (pp. 22-334).

Saleh, N., & Large, A. (2011). Collaborative information behaviour in undergraduate group projects: A study of engineering students. *Proceedings of the American Society for Information Science and Technology*, *48*(1), 1-10.

Sapa, R. (2020). Subject structure of the research area on collaborative information behaviour. *Aslib Journal of Information Management, 72*(5), 813-835.

Sapa, R. (2022). Library and information science applied studies on collaborative information behavior. *Library & Information Science Research, 44*(4), 101204.

Sarcevic, A. (2009, May). A study of collaborative information behavior in trauma resuscitation. In *AMC GROUP 2009 Workshop "Collaborative Information Behavior (CIB)," Sanibel Island, Florida.*

Shah, C. (2010). Collaborative information seeking: A literature review. *Advances in librarianship, 32*, 3-33.

Shah, C. (2014). Collaborative information seeking. *Journal of the Association for Information Science and Technology, 65*(2), 215-236.

Shah, C., & Leeder, C. (2016). Exploring collaborative work among graduate students through the C5 model of collaboration: A diary study. *Journal of Information Science, 42*(5), 609-629.

Talja, S., & Hansen, P. (2006). Information sharing. *New directions in human information behavior*, 113-134.

Tao, Y., & Tombros, A. (2013). An exploratory study of sensemaking in collaborative information seeking. In *Advances in Information Retrieval: 35th European Conference on IR Research, ECIR 2013, Moscow, Russia, March 24-27, 2013. Proceedings 35* (pp. 26-37). Springer Berlin Heidelberg.

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., ... & Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine, 169*(7), 467-473.

Widén, G., & Hansen, P. (2012). Managing collaborative information sharing: bridging research on information culture and collaborative information behaviour. *Information Research, 17*(4).

Wilson, T. D. (2000). Human information behavior. *Informing science, 3*, 49.

Zeinali, V., & Mahdavi, M. S. (2014). Triggers and barriers of collaborative information behavior (CIB) among physicians: a qualitative study. *Human Information Interaction, 1*(2), 105-117.