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Information Experience and Information Literacy

8th European Conference on Information Literacy, ECIL 2023
Kraków, Poland, October 9–12, 2023
Revised Selected Papers, Part I

Part 1

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Preface

The Eighth European Conference on Information Literacy (ECIL) was co-organized by the Department of Information Management of Hacettepe University (Turkey), the Department of Information and Communication Sciences of Zagreb University (Croatia) and the Information Literacy Association (InLitAs), France. ECIL 2023 was hosted by Jagiellonian University in Krakow, Poland and aimed to bring together researchers, information professionals, employers, media specialists, educators, policymakers and all related parties from around the world to exchange knowledge and experience and discuss current issues and recent developments.

The main theme of the eighth conference was *Experiencing Information and Information Literacy*. Contributions came from 26 different countries (Australia, Bulgaria, Canada, Croatia, Czech Republic, Estonia, Finland, France, Germany, Greece, Iceland, Kazakhstan, Norway, Philippines, Poland, Portugal, Romania, Slovak Republic, Slovenia, South Africa, Sweden, Switzerland, Turkey, Ukraine, UK, USA). All submissions were subjected to a double-blind review process. This book consists of a total of 47 selected papers out of 182 submissions (acceptance ratio is approximately 26 percent) which address a range of issues around the main theme.

Starting with the host organization, the Institute of Information Studies of Jagiellonian University, we are grateful to many organizations for their support. We would like to express our deep gratitude to all sponsors for their generous support. Our special thanks go to UNESCO for providing their patronage.

We would like to take this opportunity to thank conference keynote speakers Tim Gorichanaz, Alison Hicks, Jenna Hartel, Sabina Cisek and Monika Krakowska; authors and presenters of papers, best practices, PechaKuchas, posters, workshops; and session chairs. With thanks we acknowledge the hard work of the members of the Standing and Programme Committees who invested their time generously to make this event happen.

Our editorial team Sonja Špiranec, Joumana Boustany, Yurdagül Ünal, İpek Şencan, Denis Kos, Esther Grassian, Diane Mizrachi and Loriene Roy should also be acknowledged here. Special thanks for their hard work and valuable editorial contributions.

Last but not least we would like to thank the Local Organizing Committee.

December 2023   Serap Kurbanoğlu

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Contents – Part I

Information Experience and Information Behaviour

Contents – Part II

Information Literacy Instruction and Education

Algorithms, Artificial Intelligence and Information Literacy

Algorithms, Digital Literacies and Democratic Practices: Perceptions of University Librarians

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Abstract. Algorithms have real impacts on individuals and on society, in ways that are rarely apparent and can be detrimental to a democratic society. Librarians claim to have a significant responsibility for developing information and digital literacies, but little is known about the professional processes through which they achieve this. This study of librarians in universities in NSW, Australia, found that few claimed conceptual or practical expertise with algorithms. Responsibilities for regulating the effects of algorithms on people's everyday lives were mostly seen to lie beyond the scope of librarians, vested in government, in technology companies and the institutions of education from earliest childhood. The ethos of the university influenced the relationship between information and digital literacies and active citizenship, presenting a fragmented perspective on these literacies. Taken together, these factors are likely to weaken further the position of librarians as arbiters of authoritative sources of information in a society.

Keywords: Digital literacies · algorithms · university librarians · democratic practices

1 Introduction

In Australia, Robodebt, the name given to an automated scheme employed by a government department for debt assessment and recovery in the context of social security payments, became part of common parlance and brought the workings of algorithms to the fore. It was the people's choice for the Macquarie Dictionary's word of the year in 2019, joining phrases such as fake news and post truth, which had received similar recognition. Taken together, these words suggest a society where, in our everyday lives, people may no longer feel able to trust the information they find online or in other media sources and where the decision-making processes of organizations and institutions like government are no longer transparent. The notion of the algorithm goes further than ideas of fake news, where the veracity of the facts may be disputed, giving rise to a situation where the very information presented to us or about us has been, in some way, selected especially for us. Yuval Harari proposes that in a dystopian world where an algorithm can understand us and our thoughts and feelings better than our mothers, without us even recognizing that this is happening, this can lead to a threat to democracy [1]. While this threat to democracy, through undermining sources of information, may

not be new, and questions of responsibility for overcoming the power vested in technologies and calls for regulation by technology companies and by nation-states through legislation abound in the literature [see e.g., 2], many people are resigned to the unregulated media environment, where algorithms exert power. Yet, the view that developing skills in digital literacy can lead to informed citizens who can take on some responsibility for confronting threats to democracy persists. To explore this view, this study draws on librarians' accounts of their digital and information literacy practices and their perceptions of the links to democratic processes.

2 Literature Review

2.1 Algorithms and Algorithmic Culture

An algorithm can be defined simply as a methodology, a series of steps that create an output from inputs. Through processes such as relevance ranking, algorithms have been part of the work of librarians since the introduction of automated information retrieval in the 1970s, but, like Google's PageRank in the late 1990s, those processes were more or less transparent. These skills in information search and retrieval, that were once a significant part of the professional practice of librarians, and are still an essential part of programs of information literacy [3], are now part of everyday life. The search engines that have led to this situation are increasingly invisible, wielding a level of algorithmic authority and bias that affects search results [4]. Now, algorithms are strongly embedded in society and are found in many facets of everyday decision-making. In a rising algorithmic culture, people "delegat[e] the work of culture" to computer processes [5, p. 395], a process leading to the establishment of a new "principle of authority" and bringing with it the "privatization of process" [5, p. 406]. The use of the term delegate may be misleading since it is generally taken to involve an act of will. Yet, in everyday activities, humans use technologies to carry out activities that previously they carried out themselves. Banal tasks, such as searching for information, analysis, and so on, are part of an ever-growing list that algorithmic processes perform at the behest of humans [6, p. 139–141]. Algorithms can be seen in Foucauldian terms as knowledge apparatuses, that both support existing institutionalized truth and create truth, thus becoming a "cultural presence" [7, p. 11], through what they can do in a material sense and also through the way they are imagined. Our imaginings of algorithmic culture may lead us to a sense of the monstrous or the mysterious [8]. The folk theories that emerge support this, but also demonstrate irritation and a sense of being trapped [9].

2.2 Conceptualizing Algorithmic Literacy

Literacies are seen as essential for an individual to act effectively in a society. This has led to calls for algorithmic literacy as a means to acknowledge the control that algorithms, through their "opacity" and "proprietary nature" exercise over the people who use them [8, p. 1476]. It can also include "the skill, expertise and awareness … to create and apply algorithmic techniques and tools to problems in a variety of domains", [10, p. 4] to make people aware of the ways algorithms influence them and to empower

people. The importance of some level of algorithmic literacy has been incorporated in institutionalised approaches to information literacy, such as the JISC Framework for Digital Transformation [11]. Here, in its set of related literacies, the Framework brings together digital literacy and artificial intelligence (AI) as a subset of information literacy approach. This has the critical assessment of information and its use in the generation of new knowledge at its heart. Thus, two approaches to algorithmic literacy exist in the context of libraries, one separating the digital from the informational and focussing on making technical aspects comprehensible, and the other focussing on information and its authority, part of an established conceptualisation of information literacy.

Authority and agency are two key aspects of the critical assessment of information. Authority is vested in the information, and often assessed according to some surrogate. Challenges to established notions of authority in information have been increasing, raising the importance of a critical approach, going beyond the use of a checklist of criteria, such as that known by the acronym CRAP (Currency, Reliability, Authority and Purpose or Point of View). Such an approach would acknowledge that the trustworthiness of information, even that held in a library, may be variable [12, p. 2]. Agency suggests the capacity for action, to exert some form of control or influence. In the context of algorithmic literacy, agency is a complex concept, relating to the power that humans may have in interactions with algorithms and to the delegation of tasks to the algorithm. Descriptions of the implementation of programs of information literacy tend to take human agency for granted: it is to increase knowledge and skills, and therefore the capacity for effective interaction with information and its sources, that programs of information literacy are devised and conducted.

In the context of programs of information literacy and the assessment of the authority of information, trust has been seen at the heart of the relationship between the person, the information and the assessment of its authority, although with little concern for the person, the trustor. In a recent shift, linking agency with trust, Haider and Sundin [13] have developed a model of information assessment stereotypes, identifying the confident evaluator as an ideal, being high on trust and high on agency. Here, trust in societal institutions is recognised as situational, with the evaluator demonstrating an awareness and flexibility that is at odds with the checklist approach which focuses only on a source, deeming it trustworthy or not trustworthy.

2.3   Information Literacy, Libraries and Democratic Practices

Libraries and librarians are a part of society, and have been claimed to represent a trusted forum because of their position in a knowledge apparatus. In this role, librarians should be considered "civic agents creating civic agency" [14, p. 99]. The relationship between information literacy and democracy is expressed in the values of professional associations of librarians. The critical evaluation of information and information sources is fundamental to developing democratic societies [15]. Exactly what is meant by democracy in this context is rarely made explicit [16]. The deliberative tradition of democracy is marked by open discussion where various points of view can be brought to light, and values equality and active citizenship, while the liberal tradition of democracy is concerned with the rights of the individual to contribute to society through well-founded decisions.

Both traditions are based on information that can be used for deliberation and reflection [17]. However, the opportunities for deliberation and reflection are being eroded. Technologies are isolating people from alternative points of view [18]; algorithms are creating an "epistemological crisis" as they are positioned between the individual and the information [19, p. 11]; and posing "a wicked problem" for librarians who work to support the democratic processes that develop "an informed citizenry" [8, p. 1476].

3   Methodology

This study, exploring Lloyd's "wicked problem", takes the information literacy practices of librarians in university libraries and their relationship to social participation as an expression of established professional values and of the mission of individual universities. It used a practice theory approach [20] to interview thirty librarians from university libraries across New South Wales, Australia, with responsibility for providing information and digital literacies services to students and academic staff. Participants comprised men and women, whose professional experience ranged from seven years to more than twenty years, and included librarians who work face to face with students as well as team managers and senior managers. The interview schedule contained three parts. The first asked librarians to describe the programs and services they offer that develop digital literacies, a term that was not defined. The second focused on algorithms and algorithmic literacy. The third part sought perspectives on the relationship between digital literacies and democratic processes. In this third part, the first question adapted Niccolini's interview to the double [21], with participants being asked to recount what digital literacies are to a librarian unfamiliar with the concept and to explain how the associated services and programs are related to the development of democratic processes. Each interview lasted between 45 and 60 min, and the audio recordings were transcribed verbatim. The transcripts were first analyzed using the concept of practice architectures [20], that is the cultural-discursive, material-economic and social-political arrangements, and then thematic analysis to identify key features of the literacy practices of these librarians. Approval for the study was given through the Human Research Ethics Committee of the University of Technology Sydney, with the condition that participants and the universities where they work were to be anonymized. In the findings, all participants are referred to as female.

4   Findings

4.1   Digital Literacies and the Practices of Librarians

To understand the programs and services provided to develop digital literacy, it is important to acknowledge similarities in activities as well as to tease out how the practices differ. All participants work in libraries that provide 'LibGuides' in a range of fields of study as well as on a number of topics, emphasizing the databases of a field of study that libraries have "paid for" (001, 024). Social media platforms as sources of information are excluded from most of these LibGuides, although instructions on how to cite them may be included. These text-based products document the knowledge of librarians and are

intended for students willing to develop knowledge and skills in information and digital literacies independently. The autonomous student is the goal of the services and programs provided in several libraries, but a number of librarians lamented that attendance at information and digital literacy programs was not compulsory. During Covid-19 and in the post-Covid-19 redundancies that affected universities in Australia, several participants noted that their offerings had been "heavily scaled back" (004), now involving working in partnership with course coordinators (015). For one participant, this led to "one shot early on" (002) when they became formally part of the curriculum in a subject, with responsibilities for one or more hours of class time during a semester-long subject, whereas others (from different universities) describe their engagement as "embedded" (e.g., 022, 024, 026). "Library chat" was considered an important service offered by librarians to students in several libraries, although students "[didn't] use the library online chat because [they think] it's a robot" (004). Unsuccessful experiments – "it's disappeared" (012) – using chatbots had been attempted in at least two libraries. Across the universities, separate services are provided for research students and academics, who can set up appointments for consultations.

A key to understanding how literacy activities could be the same across libraries, but the practices they are part of differed, lies in participants' descriptions of how they would explain digital literacy to another librarian. Through analyzing references to local policies, models of professional practice and projects mentioned by participants, three practices emerged. The first is vested in the approach of the particular university, "the university's definition" (003), especially "in the context of teaching … students" (017). The second, similarly, emphasized "an institutional approach" (022), but one emerging from an internationally recognized model, "the JISC definition … I think most people would be familiar with that" (001). The JISC definition and Digital Capabilities Framework seemed to influence a number of the responses. A third type of practice was based on notions of collaborative effort either within the university or across universities, for example through "an information literacy, digital literacy project [undertaken] a couple of years ago" (003), or through "lots of discussions about the shifting nature of digital literacy" (014). While those whose practices encompassed the JISC model had a way of bringing together different forms of literacy under a heading of information literacy, those focusing on the approach of their university, which was also expressed in Graduate Learning Outcomes, or in the allocation of responsibilities for the development of knowledge and skills related to digital literacies, were more likely to have a view that there were "two types of digital literacy" (007). From the perspective of the student or academic, these were expressed as "the searching and validation part and the manipulation and use part" (e.g., 007), but from a librarian's perspective, these might be teaching the skills of critical digital literacy and teaching how to use a software package (004, 009). The acknowledgement of the two types of digital literacy can lead to fragmentation of services and also to an undervaluing of the influence of technologies in the creation and communication of knowledge.

4.2 Understanding Algorithmic Culture

Throughout the interviews, most participants gave indications that they were not confident in talking about algorithms and algorithmic literacy: "I just hadn't heard algorithm and literacy together" (008). While one participant (003) was clearly comfortable expressing an understanding of algorithms and spoke in terms of standard definitions, others "don't know" (013) and were "struggling to articulate this" (021), because "I've never had to [explain to students what algorithms do]" (020).

Approaches to this explanation of what algorithms do range from the use of practical examples from the practice of librarianship, through imaginative analogies to evocations of emotion and cynicism. The examples of the practices of librarianship included a reference to "relevance ranking" (003) and a description of algorithms as "a sophisticated use of metadata and analytics to track and monitor search behaviour" (022), while another referred to the way that search results for a specific journal article will have "these suggestions on the side, the right-hand panel" (016). An imaginative analogy proposed "[l]ots and lots and lots of little robots" with "the Big Boss Robot" who would say "You're a good employee, let's replicate you a thousand times" (006). A sense of fear was evoked in references to algorithms being put to "nefarious uses" (026) and to the "darker side of algorithms … the black box" (002), as well as in the warning that "It's just like having a gun, there needs to be a lot of thought behind it" (028). One participant described a talk she had been to recently, where the speaker had referred to the proprietary nature of algorithms, so that she had learned "how it's all driven by money" (014).

The technically oriented question about their expertise in programming was answered by most participants using a socio-cultural conceptualization of algorithmic culture. Of those who acknowledged a socio-technical approach, most noted their lack of current technical expertise: "I'm not a computer scientist". They had learned some programming languages "as a student" (020), "back in the 1980s, 1990s" (027), some have "a team now" (015) so they no longer need to be concerned with technical aspects. Many referred to their use of HTML, especially to post information and digital literacy resources to their university's learning management system. Using socio-cultural terms, some acknowledged that "you don't need to be an expert" (002) because they felt they had "a pretty good understanding of the principles" (004), in part because "you could apply a lot of the things we do as librarians, as rudimentary programming" (017).

Their socio-cultural understanding of algorithms emerged strongly in their reflections on how algorithms influenced their own behavior on the internet. The majority of examples related to online shopping and entertainment, although a very small number referred to using social media to gain access to information and news not available through other channels. While some were concerned with privacy, "being very alert to [their] behavior being monitored" (022), or "live[d] in fear' of being scammed (030), others were "inclined to switch off" (009), and even knowing their privacy might be being invaded, "we still do it" (011). Some were irritated by the "shrinking down of my options" (023) or annoyed by a sudden shift in their social media feed "because that's not what I want to use the social media for" (005). On the other hand, some "find algorithms quite helpful" (016), with examples of Amazon's recommendations of books presented (007, 011, 024).

4.3 Re-thinking Democratic Processes

There was no common view on the relationship between services and programs to develop digital literacies and the development of democratic processes. Several, influenced by the JISC model, asserted that librarians should not think necessarily in terms of digital literacy, but in the broader context of information literacy. Some librarians took a traditional position that focused on their role in striving for "free and open information" (024), while others described "educating people on what source they can rely on to make informed decisions … that's at the core of democracy" (003). Critical thinking, mentioned by several participants, is not only important for completing assessment tasks successfully, but is "an attribute of modern citizens" (025), "incredibly important in democracies to keep them functioning and alive" (026). "Giving everybody the opportunity to develop those skills" (027) was crucial.

Engagement in democratic processes was seen to encompass the need to "close the digital divide" (028), and to involve participating "to your fullest capacity … and collaborating with others … online" (029). The focus on access to information where this equated to resources in the library was focused outward in the observation that in "the whole idea of Open Access versus paying, there's a democracy issue there" (017), while (004) exclaimed "once you leave [the university and no longer have easy access to resources], there's no democracy there". The question: "how do we foster truth telling and integrity?" (022) indicates not only that focus on broader societal issues focus, but also an individual's agency in using their own knowledge and skills to "confidently control and manipulate information" (026). Several participants introduced the importance of having a voice, perhaps "seek[ing] to influence others", for example through a blog, (007) and being able to use it effectively (015), or being aware that "we have the choice about what we do and how we do it" (012), an expression of active citizenship. A small number of participants referred to "an ethical dimension" (001), including the importance "to engage ethically" and working to keep ourselves and others safe (021) and "calling out bad behavior" in our online communities (028).

Trust, trusted and trustworthy were terms used by all participants, mostly in the context of the professional practice of librarians and their relationships with authoritative or trusted sources of information. Thus, understanding the mechanisms through which trust in a source or in the information itself emerged as fundamental to information literacy and to digital literacy. Expressions of lack of trust in government and in media companies indicated a significant obstacle to democratic processes. The government was seen as both fundamental in the regulatory framework for some (003 and 015), and to be avoided at all costs by others (016). Similarly, media companies, including social media, were seen by some as important in providing information for example on how algorithms work ("Just having a note, like "you're seeing this because you searched for this" or something like that" (005)) and to be avoided on the grounds that "you don't want Facebook involved in telling you how to protect your privacy" (006).

Several participants were skeptical of providing any support for democracy (008) through their information and digital literacy programs, for example, seeing these as "hit and miss" (016), although one participant reflected that trying to embed values of social justice in students was "definitely [related to] being a good citizen" (005). Others thought that librarians could take broader approaches, activating their networks, in the university,

in the profession and more broadly, to encourage the writing of informed commentary, including by academic colleagues, to advocate for policy changes, especially with others from the GLAM sector (e.g., 007, 008, 012, 022). However, others acknowledged the reality was that "there is only so much you can do" (027) within a context where information and digital literacy education is not even compulsory for students and staff (016, 028). The education system, especially in the early years of schooling (018), was mentioned by almost all participants as being essential for ensuring that people in a community are well informed and for the development of democratic processes, with university libraries working with "people who need to be caught up" (010), and public libraries and community development agencies having responsibilities towards those not in education (009, 019).

5   Discussion

5.1   Digital Literacies and the Ethos of the University

There is no single practice of digital literacy, even among those participants whose work is framed by the JISC Framework of information literacies [11], challenging the existence of a well-founded concept of information literacies. The relationship between information and digital literacies and democratic processes is influenced by the ethos of the university. Librarians reflect on information and digital literacies being recognized as an attribute to be developed in all students through assessed coursework. But with the possibilities for developing the requisite knowledge and skills confined to as little as a one-hour compulsory session in some first-year core subjects in some degrees, and access to the broad range of optional activities and resources barely rating a mention, it is easy to see that professional values on the importance of assessing the authority of conflict with organizational constraints. Consideration of the developmental trajectory of students [12, p. 6] indicates that librarians face significant challenges developing the expertise of students in evaluating information. When digital literacies are presented in the context of assignments, it is likely that students will take an instrumental approach, for example demonstrating the application of a checklist approach, rather than achieving the higher order skills of critical thinking that engagement with the optional learning resources might facilitate.

   At the same time, librarians maintain a perspective that the sources that students should be introduced to in programs of information and digital literacies are the databases of the discipline, the resources the library has paid for. In this way, they bestow authority on these sources. It is perhaps telling that authority derives from the priority in the library budget, rather than being seen as the outcome of a decision based on professional expertise. The exclusion of social media as sources appropriate for class-based programs, except possibly for students of journalism, may reflect the expectations of subject coordinators rather than librarians, but the inclusion of instructions for referencing social media in some LibGuides would suggest that students do make use of these sources. Thus, the binary divide is (re-)created [11, p. 6], with library resources being deemed trustworthy and those outside the library being deemed untrustworthy.

5.2   Not Understanding Algorithms

The interviews and other materials provided very little evidence of significant engagement in algorithmic culture either conceptually or practically, at the professional or personal level. Most participants fell into the category of those who "are in the dark about how [algorithms] work" [22, p. 74]. However, from a professional perspective they were reasonably well informed about why algorithms can be a threat to democratic processes, and in their capacity to affect the information provided, whether through use of search engines or databases or through social media feeds. Here, delegation of agency to an algorithm [5] is seen as undesirable, whereas delegation for recommendations for reading or music choices or recommendations for purchases, examples of Willson's [6] everyday tasks, was welcomed as bringing to attention otherwise unknown options and acted upon.

For librarians, the insitutions of scholarship, especially in peer review and the reputation of certain publishers, lead to institutionalised truth, and they understand the processes through which truth, in the form of new scholarly knowledge, is created. Algorithms, acting as knowledge apparatuses [7], institutionalise and create truth in ways that are hidden and that librarians do not know. This lack of understanding leads them to focus on the knowledge apparatus they are familiar with. First, they emphasise the importance of the principles through which authoritative information can be identified, regardless of the source of the information and in a related move, some note the significance of open access to journals and other forms of information which have been created through the existing knowledge apparatus, but which are not behind a paywall. Second, they insist on the importance of education in creating the kind of knowledge apparatus that will lead to a shared societal understanding. Thirdly, some conceptualise the undue influence of algorithms as a regulatory issue, with responsibility falling to the government to take some legislative or policy action, or to the commercial organisations under whose umbrella the development and implementation of algorithms falls to ensure that they act according to some standard acceptable to society. Fourthly, there is some mention of the media as the fourth estate, able in its traditional role to speak truth to power. The lack of trust in government and big business and especially in the media suggest that for these librarians there is no easy way to maintain the institutionalised approaches which have underpinned their professional role.

The gap in knowing how algorithms work is also filled by the imagination. Lloyd [8] uses a reference to Frankenstein to encapsulate the fears that something monstrous is being created. Participants in this study do not express these fears directly. However, the insistence on standards of ethical behaviour and the need for people to learn how to safeguard their safety suggest that social norms are breaking down, and that something fundamental to the creation of truth is changing, with the need to be willing to call others to account. Here, some responsibility for maintaining the knowledge apparatus is given to individuals, perhaps in the hope that agency in the form of a groundswell of small-scale local actions can reclaim some of the agency delegated to algorithms.

5.3   Democratic Processes, Pessimism and Optimism

The majority of the librarians who participated in this study do not appear to be optimistic about their own role in the development of democratic processes, understood as

supporting the existence of deliberative democracy through maintaining an informed citizenry, although they place their hopes on the role of public libraries in a community, acknowledging their potential for creating "civic agency" [14, p. 99]. There is some emphasis on the development of graduates who will be effective professionals, able to play their role in business, industry and the professions, acting responsibly and ethically, an approach that might be seen as part of the liberal tradition of democracy [16]. However, if trust is a key feature of a democratic society, then the lack of trust in the institutions of truth in society, especially in government and the media, insitutions that play a key role in a traditional knowledge apparatus, leads to a pessimistic conclusion.

Teaching students to identify trusted sources and trustworthy information remains at the heart of librarians' role in developing digital literacy. Yet, in spite of the implicit recognition that the knowledge aparatuses that institutionalise and create truth are changing, there is little evidence that these changes are bringing about a change in the way that trust is conceptualised. Even in those circumstances where librarians contribute actively to the development of graduate learning outcomes, the focus remains on the sources of information and the surrogates through which the trustworthiness of the information can be assessed, rather than on the development of the student as assessor of these sources, in the way that the model proposed by Haider and Sundin [13] suggests.

The evidence of participants embracing notions of active citizenship, whether through contributions to public discussion through a blog, calling out inappropriate behaviour online or through concerns for online safety and well-being and other forms of ethical behaviour, must give some cause for optimism, as individuals adopt new norms for working online. Although the effects might be small, these actions would go some way towards ensuring that technologies do not create the isolating filter bubbles that concerned Lor [18]. However, as they do not confront the changes in knowledge apparatuses being brought about by algorithms, they do little to address the "epistemological crisis" identified by Head et al. [19, p. 11].

The outcomes of this study have significant implications for the education of librarians throughout the world. Information literacy is a powerful concept, and this power in part has accrued because librarians have been able to simplify it to apply at many levels in society, while maintaining the integrity of its principles. This is the approach taken by a number of the participants in this study. They emphasise the importance of identifying keywords to conduct searches and the value of checklists to evaluate the information found. Programs of education and in continuing professional education could help to address the epistemological crisis, and the undermining of democratic processes if, in the context of contemporary algorithmically dependent society, they include a re-consideration of the search process, an emphasis on the development of the user as evaluator of information, and an acknowledgement of the contemporary citizen as a potential creator of information.

6   Conclusion

This study aimed to heed Lloyd's call [8], for scholars and librarians to consider how they address the impact of algorithms on everyday life, in the context of information and digital literacies and of democratic processes. The findings showed little evidence of a focus

on algorithmic culture. Librarians' understanding of algorithmic literacy ranged from relatively naïve to passive acquaintance especially through social media, with few claiming conceptual or practical expertise. The relationship between information and digital literacies and active citizenship was influenced by the ethos of the university, presenting a fragmented perspective on the role of these literacies in supporting the development of democratic processes. Responsibilities for regulating the effects of algorithms on citizens in their everyday lives were mostly seen to lie beyond the scope of librarians, vested in government, in technology companies and the institutions of education from earliest childhood.

Overall, a pessimistic view emerged of librarians with strong professional values, embedded in a shifting knowledge apparatus, but without the trust in the major institutional forces in that system to take appropriate regulatory steps towards an appropriate adaptation of it. They presented a socio-cultural understanding of algorithms, which enabled them to identify threats to democracy, but as a group they lacked the socio-technical knowledge that might have helped them to understand and explain more clearly how algorithms work, an aspect that could be incorporated into programs of professional development. Although this socio-cultural approach has given them some ways to propose actions in support of democratic processes, these approaches do not help them to strengthen the position of librarians as arbiters of authoritative sources of information in a society.

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Using Early Responses to Wikipedia and Google to Consider ChatGPT

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Abstract. ChatGPT and other generative AIs are raising important issues in information literacy that are unique, but not without precedent. The rise of Google and Wikipedia were accompanied by similar paradigm shifts. Exploring librarians' early responses to these tools allows us to use that history to inform our approach to generative AIs. This exploratory study looks at social media posts, including email listservs, as well as sampling the professional literature to see librarians' reactions in terms of impacts on the profession and the resulting pedagogical approaches to teaching information literacy in the early days of Google and Wikipedia.

Keywords: ChatGPT · artificial intelligence · history · Google · Wikipedia · information literacy

1 Introduction

Generative artificial intelligence (AI) tools such as ChatGPT are transforming how people interact with information with significant implications for information literacy. The technology has quickly become widespread since the release of GPT-3 by Open AI in November of 2022. ChatGPT and similar large language model AIs exist as stand-alone interfaces capable of producing original content in response to user prompts, as well as being integrated into other environments via API. As of this writing, for example, both Microsoft and Alphabet are experimenting with AI generated text summaries of the search results in their respective search engines, Bing and Google.

There are significant implications for information literacy when one is able to interact with an information retrieval tool conversationally and get coherent answers to questions posed, in addition to (or instead of) links to the documents informing that answer. Similarly, ChatGPT's ability to generate adequate and highly specific topic overviews makes it attractive as a source of information in itself, but one that obfuscates the link between evidence and argument. That is to say, it cannot cite the specific sources it draws on in generating text beyond referring to its vast training data and the algorithms used to process them. In its own words, "I don't directly access or cite specific databases or sources of information as one would for a research paper. When answering questions, my responses are based on the collective knowledge that's been modeled during my training process". And more to the point, "I don't have direct access to my training data or know where it came from". So then, in ChatGPT, we are encountering both a new

way of searching for a new kind of content and a novel type of resource with a novel production process.

Librarian responses to these developments range from seeing the opportunity for a renewed "golden age" of information literacy, if faculty shift their focus from product to process, to calls for making the mechanics of creating prompts for generative AI a key part of information literacy instruction [1, 2].

While this state of affairs is unique, it is not unprecedented. Google, launched in 1998, and Wikipedia, created in 2001, presented librarians with similar issues. Google, in providing an effective search system for Web content, changed both the how and what of search. Wikipedia explicitly challenged traditional notions of expertise and the publication process. How librarians reacted to the introduction and growing dominance of Google and Wikipedia can inform and clarify our reactions to ChatGPT and how we approach it in the context of information literacy.

Towards understanding those early reactions from librarians, I conducted an exploratory review of email listserv messages, blog posts, and published articles related to Google and Wikipedia primarily in terms of information literacy and library instruction.

2 Background

"From the point at which an end user determines a need for information through information access and manipulation, all the way to retrieval and dissemination, technology is making it possible to operate without the help of a librarian" [3].

While changing technology has always impacted information creation, access, and use, the twenty-year period from 1990 to 2010 is especially notable for fundamentally reshaping the information landscape for both scholarly communities and the general public, worldwide. By the early 1990s, it was becoming common for academic libraries to offer their users at least some unmediated database searching. For the first time, a scholar's ability to access information was dependent on their ability to effectively search databases. This disintermediation was accompanied by concerns that patrons preferred searching "marginal" databases themselves "than to pay a small fee for a search in a more appropriate subject-specific online database" [4]. As limited full-text coverage of journal articles became available, "content clearly becomes secondary to convenience. Students will modify their topics or ignore relevant bodies of information if they are not covered by a [full-text] CD" [5].

These changes in library services were occurring at the same time of the rapid growth of the Internet and the development of the World Wide Web. The web greatly amplified the importance of the convenience-versus-quality calculations. Its unparalleled convenience was accompanied by the lack of the usual processes that ensured some measure of quality in even the most "marginal" databases provided by the library. As the then president elect of the American Library Association would infamously put it in relation to bloggers, "the unpublishable, untrammeled by editors or the rules of grammar, can communicate their thoughts via the web" [6].

While librarian reactions to the web itself would undoubtedly also make for an interesting study, from an information literacy perspective, and especially from my perspective as a discovery librarian, the rapid adoption of the search box as the primary (and, for many, nearly exclusive) information retrieval tool is of particular interest.

Made available to the public in 1998, Google was not the first search engine on the web. However, Google's emerging dominance around the turn of the millennium coincided with a change in the status of the Internet "from being the dazzling new thing to being a purposeful tool that Americans [and others] use to help them with some of life's important tasks" [7]. Thus, discussing Google became synonymous with discussing web search, the changing information landscape in general, and the use of unvetted information systems instead of those made available in the library.

There are some additional factors that make librarians' reactions to Google especially interesting. Despite the existence of Google Directory until 2011, Google was part of a switch from a front end, subject directory model of information organization to one based in bibliometrics, a change from trying to organize the web like a library, to trying to organize it like a database [see Borgman's discussion in 8]. Google changed how pages were found and, because of its dominance, quickly began to influence how websites were created and linked. Though obviously an overstatement, Lesk's summary of web search is illustrative: "After a brief interval in which everyone complained that there were too many responses to any query and that it was too difficult to find the good ones, Google introduced quality rankings based on web links and solved the problem" [9]. For librarians, instruction on search and selection of resources quickly often became framed in relation to Google, even when the emphasis was on databases provided by the library.

Just as Google became the embodiment of the changing processes of information discovery, Wikipedia became the epitome of the wisdom of the crowd over the expertise of individuals. Launched in 2001, Wikipedia intentionally and explicitly positioned itself as an alternative model for producing an information source, one in which anyone can contribute as a writer or editor, without regard to any recognized expertise or specialized knowledge outside of Wikipedia itself. This model, and Wikipedia's swift and widespread adoption as a resource heavily used by students, generated a multitude of strong opinions from librarians, and correspondingly rich discussions and pedagogical approaches.

Taken together, Google and Wikipedia are useful proxies for the rapid changes to the information landscape and the corresponding increase in emphasis on a conceptual model of information literacy over the narrower set of skills represented by bibliographic instruction. Librarians responded to these developments both in the published literature and, less formally, on email listservs, blogs, and other social media. At the time of Google's launch, email listservs in which a subscriber could send an email to one address for distribution to all subscribers, were the dominant way for librarians to have nearly real-time conversations about matters of professional importance. Social media in general, and listservs in particular, include a wider array of voices and a broader reach than the relatively few librarians who publish in, or read, library literature. The Bibliographic Instruction Listserv (BI-L), for example, had nearly 3,000 subscribers when it was replaced by the Information Literacy Instruction listserv in 2002. As one librarian posted to BI-L in 1999, coincidentally in the same post that makes the first

mention of Google on that list: "I get a lot out of this knowledge forum--much more so than reading professional journals!" [10].

Email listservs, as well as blogs and their comments, and other social media, also present more of a conversation, with participants responding to, disagreeing, and elaborating on ideas. Both the greater diversity of voices and the conversational nature make these informal sources especially useful for the purpose of exploring librarians' early reactions to Google and Wikipedia.

3   Methods

To find likely forums where librarians' early reactions to Google and Wikipedia would have been recorded, I searched the web for publicly viewable archives of English-language email listservs related to discussions of information literacy, with coverage of dates within the 1998 to 2010 period.

The archives I found were:

- LIS-INFOLITERACY, LIS-INFOLITERACY@JISCMAIL.AC.UK, available at https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=lis-infoliteracy covering 1998-present.
- Bibliographic Instruction List, bi-l@listserv.byu.edu, available at https://web.archive.org/web/20031202023458/http://bubl.ac.uk/mail/bild/, covering July 1995 to the discontinuation of the list in May 2002.
- Information Literacy Instruction List, ILI-L@ala.org, incomplete archives available at https://web.archive.org/web/20040803020423/http://bubl.ac.uk/mail/ilild/ covering the beginning of the list in 2002 until January 2004, with a few gaps.

For each list, I search the archive for "Google" and "Wikipedia" and examined results that occurred before 2011. If the comment suggested substantive discussion, rather than simply mentioning the tool as a tool (e.g., "Take a look at http://en.wikipedia.org/wiki/Screencast for an overview of several different tools"), I read the threads that contained those terms, noting general themes and ideas. If links to blog posts or articles were included, I followed those, and analyzed those as well. I followed the same procedure using the terms "web search" and "search engine" to find relevant threads prior to 2002. Though archived on the web, email posts, particularly ones in the early days of Google, may not have been thought of as publicly findable information. I therefore treated these more similarly to anonymous ethnographic data than to publications, declining to provide citations to specific posts, quotes, or individuals.

I took a multi-pronged approach to find blog posts (and their comments) that recorded librarians' early reactions to Google and Wikipedia. As mentioned above, I followed links from email messages to specific blog posts, using the Internet Archive (https://web.archive.org/) for blogs that are no longer online. I also performed a variety of Google searches for information literacy related blogs published prior to 2011 and then used the search tools in those blogs to find posts related to Google and Wikipedia. I performed similar searches in the Internet archive and browsed (as search functionality is not preserved by in the archive) the most relevant seeming blogs I found that way.

To find relevant social media posts, I searched Twitter using the following search: (Google OR Wikipedia) AND (infolit OR "information literacy" OR "library instruction") until: 2009-12-31.

To sample the relevant published literature, I searched the University of New Mexico's instance of the EBSCO Discovery System (EDS) for ("bibliographic instruction" OR "library instruction" OR (Librar* N5 Orientation) OR "Information literacy") AND (Google OR Wikipedia) with the date limited to 2010 or prior. Rather than a comprehensive review of the literature, I subjectively selected results that seemed especially relevant to understanding librarians' reactions.

3.1 Limitations

There are many limitations to this study, some inherent to the nature of the data available and others as a result of my choices in designing the study.

First, is the very notion of "early reactions". The 2010 cut off that I use is somewhat arbitrary, being about a decade after the tools were introduced. On the one hand, 2010 seems very late for an "early" reaction to Google. On the other hand, from an historical perspective, we are likely still very much in the early days of reckoning with the changes the internet brings to librarianship. The 2010 date was chosen to encompass the dominance of Wikipedia, which came late relative to Google.

A second limitation is the availability of the record. The archives of many listservs, as well as blogs and websites, and other social communities from that period, are no longer on the web. It is largely a matter of luck if they have been preserved in the Internet Archive, and whether I was able to discover them there. It is also possible that the Internet Archive's processes result in a greater likelihood of certain perspectives being preserved than others. A web crawler, for example, might archive blogs with a similar viewpoint that link to each other, but not encounter links to those with disagreeing viewpoints.

When articles or posts point to online resources that have themselves vanished or changed, it can be impossible to understand the point that the author was making at the time. For example, one post suggested that web search engines were not "professional", relying on the suggestion to "try searching Google for 'canaries' and see what the top answer is, or 'orange' for that matter!" Without knowing what a 2008 Google for "orange" would have retrieved, it is difficult to infer what was meant by not professional.

It also seems likely that viewpoints that were more enthusiastic about the Internet would be overrepresented in blogs and possibly on listservs and in publications as well. This is mitigated somewhat by people responding to opinions and processes expressed offline, though we cannot know how well their opinion is represented. For example, we know from Baur [11] that some librarians hung signs advising patrons to avoid Wikipedia but I did not encounter any librarians explaining why they adopted that practice.

To comply with a strict interpretation of the University of New Mexico's guidelines on research involving human subjects, I limited my exploration of social media, including listservs, to those artifacts that are freely available on the web without requiring any authentication. This excludes, for example, any Facebook groups that may have existed at the time.

Finally, as the purpose of this study is exploratory, my analysis is purely qualitative. I make no effort to track what reactions were more or less common. Nor do I attempt to

produce a catalog of all reactions. Instead, I subjectively considered whether the reaction could help us consider ChatGPT and other generative AIs. A different researcher might find different interpretations in the same source material.

4   Findings and Discussion

There are several broad categories of reactions to Google and Wikipedia and web content more generally. These include discussions among librarians of the strengths and weaknesses of the tools themselves and how to learn how to use them effectively, discussions of their impact on information literacy and librarianship, and pedagogical approaches for addressing them in instruction or services.

4.1   Learning the Tools

The early years of the web saw countless workshops for librarians and educators on building knowledge and skills as web users. While many librarians expressed confidence that librarians know more than most about using the Internet as an information tool, others expressed an uncomfortable lack of knowledge and experience. Some people expressed the concern that librarians and instructors, feeling that the students knew more than them about new online tools, were hesitant to engage with these tools with students. A similar concern was that librarians were overestimating the students' understanding of the tools and so underestimating the need for information literacy. Librarians' own understanding of the tools came from both experimentation and formal instruction, with insights shared through professional networks. These included technical tips, such as adding less than and greater than signs ($<>$) to Google searches to "focus" results, emergent structural issues, such as an observation that Google's use of inbound links leads to popular sites becoming more popular, while making it harder for newer sites to rank; and external structural concerns, such as that viewpoints backed by organizations with substantial resources will dominate Wikipedia, based on their ability to mobilize the "volunteer" labor that powers the site.

4.2   Impacts on Librarianship

The second category of reaction is about the impact of these technologies on information literacy and librarianship. These ranged from worry about the collapse of libraries due to the new tools, reflected in statements wondering why one would need a reference librarian if everything can be looked up on Wikipedia, or if Google Scholar will kill off scholarly databases, to considering shifting priorities of information literacy programs. While, as of this writing, neither libraries nor scholarly databases have been killed off, some of the ideas raised in these discussions remain relevant to discussions of ChatGPT: whether a single easy-to-use interface is preferable to multiple, less user-friendly but more powerful subject-specific interfaces; whether our goal should be to promote thinking "like a librarian" about information systems or to develop systems that work for students "where they are" are two examples from these conversations.

The discussions of shifting priorities for information literacy are of greater interest. In the early 1990s it was up for debate as to whether source evaluation and thinking critically about information were appropriate topics for library instruction [12]. This became a key concern with student use of Wikipedia and Google and I encountered no suggestion that this was beyond the scope of library instruction. Some saw the perceived inability of students to effectively evaluate information as a result having only ever been "spoonfed" information from textbooks, assigned readings, and the like. This also ties into the trend of disintermediation that had already been taking place in libraries, and included both instructional goals, represented by comments such as "if I can just introduce the notion that there are good websites as well as bad, and that the student shouldn't just take information at face value, I feel they may have learned something", and the balance between pedagogy and usability in system design considerations: "Appreciating the complexity of some databases is after all a subset of appreciating the complexities of information and information management".

The scope of critical thinking instruction also expanded, from relatively simple models of resources as either scholarly or popular and reliable or not, to one that encompassed the range of genres, expertise, and social issues around information that students were encountering.

An interesting aspect of the early reactions to Google and Wikipedia was the emotional or psychological toll on librarians. Laura Cohen's widely shared "A Librarian's 2.0 Manifesto" from 2006 included statements about having courage, not being defensive, and not fearing Google or related services [13]. It is telling that these terms were included and that the manifesto resonated so broadly. Similarly, the CIBER report on the "Google Generation" in 2008 described the library world as "a state of turmoil and anxiety" [14].

Though the 2008 archives of the Information Literacy – L listserv are not currently available online, Polkinghorne and Hoffman's analysis of the posts from January to October of that year found that often "Wikipedia has been cast not merely as unreliable, and not merely as lacking trustworthy editorial processes, but as evil" [15]. This fits with stories that seemed to be parables of the return of the prodigal patron. After relying on Wikipedia or Google, the stories go, the student would face dire consequences (often in the form of their work not being accepted by an instructor) and finally seek out the librarian's assistance, for which they were immensely grateful. These stories seemed to serve as reassurance for the role of librarians, and were interesting for the insights they provided into how students' work that relied on Wikipedia and Google was received by their instructors.

Given the broad claims that AI will replace broad swathes of human labor, it is worth paying attention to the stress and anxiety that an increasing focus on ChatGPT has on our workforce.

4.3 Pedagogical Approaches

Librarians found themselves both trying to help students understand Google (and the web content it retrieved) and Wikipedia's place in the information landscape and needing to teach how (or whether) to use those tools. The first of those was frequently done by analogies, that themselves provide insight into what was most salient to the librarian.

Many analogies focused on quality of content. Examples of these include suggesting that web content is like drinking muddy polluted water compared to the filtered water of the library; searching the web is like asking friends, family, or strangers for medical advice, while the library databases are like asking a doctor. Other analogies focused on the premium experience of using library databases, likening databases to boutique stores or limo rides compared to junk shops or public transit. Still others focused on the organization, likening the web to a shoe box (or a room) full of unsorted papers and library databases to filing cabinets. Some focused on the appropriateness to the task, such as suggesting that "if Google is basic like a hammer or screwdriver, then Ovid MEDLINE is a torque wrench" to make the point that even if undergraduates can complete their work with simple tools, it does not mean that the more sophisticated tools are not necessary.

How librarians approached teaching with Google and Wikipedia can be grouped as "Rejecting", "Reinforcing", and "Revolutionizing". Rejecting approaches, for example, took the stance that Google or Wikipedia are not appropriate tools and should not be used, including forbidding their use outright, as evidenced by statements like "we discourage students from searching the Internet, period", posting signs advising students to avoid using Wikipedia, or emphasizing that instructors may not accept Wikipedia as a source. While rejecting approaches often were based on the assumption that the content was of irredeemably low quality, it also reflected the view that the librarians simply did not have the capacity to teach their effective use. Responding to a call for a more reasoned response to Wikipedia, for example, one librarian wrote "Mr. Baur cannot be faulted for encouraging librarians to instruct patrons in how to properly evaluate Wikipedia's contents, but his utopian imaginings get the better of him in mistakenly believing that what librarians are capable of accomplishing by virtue of their training is the same as what librarians, in reality, can accomplish, with limited time, staffing, and resources, on a weekly basis" [16].

In some cases, classroom activities were designed to convince students not to use specific tools, such as having groups race each other to find specific information, with one group looking in books or databases, while another uses Google to search the web. An activity with a similar goal involved students comparing a Wikipedia article to a scholarly article on the same subject as a way of highlighting the problematic content on Wikipedia. It is worth noting that in at least one case this last assignment backfired, when one experienced Wikipedia contributor was in the class. "Before most students had got round to the piece of work, he went into the Wikipedia article and improved its quality by updating the content and referencing the article!" [17].

Reinforcing approaches were ones in which Wikipedia and Google were incorporated into pre-existing models of teaching information. Examples of reinforcing approaches included using hoax or misinformation websites to teach evaluation ("In some ways, this is similar to when we used tabloid literature in the past to teach evaluation skills"), comparing relevant and irrelevant subject headings (e.g., "siblings" applied to an article about the musical group The Righteous Brothers) with relevant and irrelevant keyword matches to highlight the problems of synonyms in searching, and using students interest in searching Google to engage them with Boolean and other advanced search techniques that also apply to scholarly databases.

Revolutionizing approaches exploited features of the tool that allowed for new ways of engaging with information literacy. Examples of these included using Wikipedia's talk pages to show the process by which a consensus about an entry is reached, using Google as a case study in a credit-bearing information literacy course, and encouraging students to create websites or edit Wikipedia as opportunities for learners to engage with concepts such as scholarship as conversation, and to see themselves as members of the scholarly community.

Interestingly, web page creation and Wikipedia editing were also used in Rejecting approaches. In those cases, a cautionary message was intended: what you find online could have been written by anyone, even you. In some ethically dubious cases, students were encouraged to create hoax websites or introduce errors into Wikipedia. Whereas in Revolutionizing approaches, students were positioned as contributors to the scholarly record, albeit in a limited way, in Rejecting approaches they were positioned as potential vandals, whose very access to a system undermined its credibility.

4.4 Evolving Services, Changing Contexts

An interesting consideration to keep in mind as we consider ChatGPT is the way Google in particular has changed. While the early insights into the strengths and weaknesses of Wikipedia are largely still relevant today, the same is not true for Google. Both Google and the web have changed in ways that render some early observations obsolete.

Many early reactions to Google noted the limited nature of what Google searched, essentially just the text of freely available websites. Since then, what Google indexes has expanded considerably to include not only images, and the text that appears in images, word-processing documents, PDFs, and other formerly invisible file types, but also the full text of books, articles (both scholarly and not), and other content that, while discoverable by Google, a user can only access through a paywall. Some of these changes are due to technological changes but others are due to changes to the web and changes brought about by the increased importance of Google itself. Content creators that may have previously tried to prevent Google from indexing their content, including online library catalogs, now see value in being discoverable via Google.

Similarly, since the introduction of the Google Knowledge Graph in 2012, earlier observations that, unlike a librarian, Google can only give links and not answers, are less relevant. Some librarians pointed out that librarians, unlike Google, know who you are and so are better able to guide you to information appropriate to your context. While this remains true in the context of scholarly projects (where the librarian may know the expectations for the course and the assignment), Google's personalization of search results based on past searches, web history, current location, and other data associated with one's account make other concerns more salient than that Google does not know enough about its users.

Early observations also sometimes were limited by relying only on current practices to assess technological innovations. In a prominent criticism of Google Books, for example, Michael Gorman suggested that digitizing books was a waste, arguing that contextless snippets of books are useless, and printing out 500 pages to read would be unappealing. While many criticized Gorman's response at the time, none that I encountered suggested that these digitized books might become useful training data for AIs that

would, in fact, be able to summarize Gorman's own books, and use them to provide a reasonable guess at how he might respond to ChatGPT itself.

4.5   Key Differences from Generative AI

A few key differences from our current context became apparent when reviewing the early reactions to Google and Wikipedia. Perhaps the most striking difference is between the democratization of information creation that accompanied Google's rise and is the basis for Wikipedia, and the centralization that necessarily occurs with large language models. While there was, and is, much concern for the dominance of one, commercial, tool for search, Google was enabling direct access to content from, theoretically, anyone. ChatGPT, on the other hand, presents as its own single voice, obfuscating the relationship between its output and the content creators on which it relies. Some critiques of Google referred to it as an oracle, because of the seemingly blind faith students had in the information they found with it. But this descriptor is much more apt for ChatGPT. How we approach evaluating the content from these systems will need to be much more conceptual and systemic than the techniques we used when we had at least some information about the authorship of any given work.

A second difference is highlighted by an early debate about whether libraries should put links to Google on their library's webpages. Some argued for doing so because that was what patrons wanted to access online, while others argued that libraries should promote their own higher quality resources. This debate reminds us that, in early days, you could not assume that people would even know how to get to a search engine, never mind use one. In this context, teaching people how to use web search engines made a great deal of sense. Librarians had considerable experience searching databases of scholarly articles, an expertise that transferred reasonably easily to searching databases of websites. And while online forums about search engines existed, someone who was not an effective web searcher would not find them. Their librarian was likely the most expert searcher they had access to.

Today, however, one would assume that people who are unfamiliar with ChatGPT are nevertheless able to find and use Google. This means that people are much more self-sufficient in finding help for learning how to use ChatGPT: they can google it. While librarians do bring considerable expertise in considering generative AI from an information systems' perspective, we do not necessarily have a deeper history of prompt engineering. Most librarians will not be the greatest source of expertise available to people looking to gain skills in using AIs.

Similarly, as mentioned above, teaching Google was sometimes used to engage students with database searching: the skills that made Google searches better could also be applied to the similar, if more complex, scholarly database interfaces. As of this writing, there are no major scholarly databases that are queried with the sort of prompts used in ChatGPT. If and when those are developed, it will presumably be because that way of interacting with information systems has become common and expected. So, at the moment, teaching students how to use specific commercial systems does not have a generalizable benefit and by the time it does teaching basic skills will not be necessary. This is not to say that there is no role for teaching prompt engineering, but the scope

and purpose will be far narrower than they were when teaching web search skills to new internet users twenty years ago.

A final, but significant, difference is the increased awareness of the climate impacts of energy intensive information technologies. While there may have been some discussions of climate impact of Google or Wikipedia in the early reactions of librarians, it is a much more prominent issue with ChatGPT. Climate change is more broadly recognized as a crisis than it was twenty years ago. Many libraries are undertaking sustainability initiatives, and our patrons too are more cognizant of environmental trade-offs in their decision making. The resource intensiveness of generative AI, even compared to traditional web-searching, needs to inform our response to and adoption of these tools.

5 Conclusions

"The biggest technological impact in our library … has been full-text CDs" [5].

The issues that generative AIs are raising for librarians are unique but not novel. By looking at how librarians responded to earlier technologically-driven reshapings of the information landscape, and the introduction of Google and Wikipedia in particular, we gain insight into our current situation. We see that these are not seismic events disrupting a static environment, but rather occurrences that extend and intensify forces that were already present. Their disruptive power is no less disruptive for that knowledge. How we respond to those disruptions, however, can be informed by our history, rather than being doomed to repeat it.

Based on this exploratory study, it seems that information literacy's move to a more conceptual analysis of information systems in society, rather than a skills-based focus on tool use, serves us well. We should not confuse our good and appropriate curiosity on exploring AI-based tools with a mandate to teach their use to communities that have many other, often better, sources available to them.

For the immediate term, for those libraries that have the capacity, collaborative explorations of generative AI, perhaps with students in the form of credit-bearing classes modeled after Ghapery's [18] course on Google, hold considerable promise. Such a course, framed as a "we are all learning together" exercise, could have students exploring image, text, music, video, or whatever other generative AIs are available, using information literacy as the framework for understanding and evaluating the social, legal, ethical, environmental, and economic impacts and implications of those services. This approach, rather than one that emphasizes either "how to" or "do not", makes appropriate use of the expertise of our discipline, furthers our professional value of collaborative inquiry, and develops the information literacy of participants, and ensures that information literacy is part of the discussion around the adoption of generative AIs.

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Trust, but Verify: Students' Reflections on Using Artificial Intelligence in Written Assignments

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Abstract. This article focuses on students' reflective assignments (n = 26) on using AI chatbots in the short literature review writing process. The opacity of text-generating AI software is impenetrable, yet the flaws in the output provided by AI chatbots sooner or later drive users from trusting to verify the information. The affective component of using AI chatbots is noteworthy as students experiencing time stress or lack of ideas need a 'helping hand.' However, with too few experiences in using AI chatbots, they do not anticipate that seemingly fluent text contains hallucinated references and false or machine-like content. In that case, the need to verify the information comes by a surprise, as the time initially reserved for the home assignment is no longer sufficient. Practice and peer-to-peer discussions about AI chatbots in the framework of information literacy related courses can help reduce problems related to using AI chatbots.

Keywords: Information literacy · artificial intelligence · short literature reviews · academic writing

1 Introduction

This paper discusses students' first-hand experiences of using AI chatbots in a written assignment, specifically, the short literature review writing process. Short literature reviews as a genre have been traditionally used to assess students' academic progress and have been treated as a tool to improve their information literacy skills [1–3]. Nevertheless, as academic writing is a laborious task [4], students may sometimes have the temptation to find 'shortcuts' [5]. The latest technology in the face of AI chatbots comes up with new unseen possibilities to do so, providing a coherent, albeit somewhat technical, yet stilted output [4, p. 1122]. However, algorithms' opacity in AI chatbots renders these tools comparable to so-called 'black boxes' [6]. Thus, recent publications discussing issues of trust, and lack of transparency [6–8] in search engines or algorithmic culture provide us with valuable starting points. This article thus joins the rank of studies discussing information literacy in increasingly opaque information environments [6, 8–10]. By relying on students' reflective assignments from the course 'Information Behavior Theories and Practices' (at the University of Tartu) in March 2023, I seek to understand students' experiences of using AI chatbots in the process of writing a short literature review. These insights can be helpful in delivering information literacy instruction in a changing learning environment shaped by the coming of AI chatbots.

2   Theoretical and Empirical Background

Although using text-generating AI software in students' home assignments is a relatively novel topic, several earlier works support the current study. In the Library and Information Sciences, a critical approach to the opacity of search engines has recently been theorized [6–8] often from a sociomaterial perspective [11] and supported in several empirical research papers [12–14]. The list of problems related to the lack of transparency in search engines, especially Google, is lengthy. There is secrecy around the working principles of the Google search engine: its algorithms, index, and data principles [7]. The secrecy produces the threat that users vest too much trust or faith in Google [15], so "In Google We Trust" with or without a question mark is the often-used title in scholarly papers (see [16]), capturing and re-announcing the repeating sentiment among information seekers. Users approach the Google search engine as a neutral or objective information source [7, p. 39] without noticing the multiple biases [7, 17] that shape our understanding of knowledge and society. At the same time, online information searches are deeply rooted in our everyday lives, being part of "all kinds of social practices" [7, p. 3]. The learning process is one of these social practices, left untouched by the afore-mentioned problems bound to the use of search engines [18, 19].

Furthermore, the rapid changes in computational systems are partly responsible for the need to revisit the concept of (media and) information literacy [6, 8]. The need to reinvent the concept of information literacy is critical for several reasons [8], yet in the context of the current study, the question of the responsibility of the user in understanding the working logic of the informational infrastructure [8, p. 47], the need to maintain currency of information literacy skills needed to use that informational infrastructure [6, 8–10] and the necessity to see through the biases in seemingly neutral values [8, p. 142] are of particular importance. The recent problematizations of search engines (or Google in particular) and critical notes on media and information literacy thus provide us with solid foundations to analyze and discuss the usage of AI chatbots in the students' home assignments.

This paper focuses on a particular part of learning: writing short literature reviews. Short literature reviews and essays have been a traditional tool of academic assessment at universities [4]. Short literature reviews, just like many other written assignments, allow exercising and assessing multiple academic skills that are tightly knit with overarching information literacy competencies [1–3]. Short literature reviews work as tools for putting students into a position where they need to retrieve previously published information and, by analyzing and synthesizing it [1], present new knowledge. The skills of retrieving quality information from reliable information sources and presenting it transparently (so that the reader can trace where the information was taken from) are a few of the essential competencies or core activities [7, p. 112] needed for this sort of written assignments.

Preparing a quality written assignment is laborious [4]: it is time-consuming, knowledge-intensive, and sometimes a stressful task [2], especially when not conducted regularly. Therefore, students have sought shortcuts to pass the tiresome task, typically through various forms of contract cheating [5]. AI chatbots or generative 'Transformer' AI systems such as GPT-3 are said to 'democratize' cheating [4, p. 1120] for their convenience and free access or low price [20]. Assuming that "AI-assisted writing is already

deeply embedded into practices that students already use" [21, p. 2], the faculty and university administrations have, in early 2023, made hurried efforts to regulate the situation. Many universities have strictly banned ChatGPT during the study process [22, 23]. However, there are also universities that, instead of completely banning, approach AI chatbots cautiously yet curiously [24–26]. The university where the current study was completed is among the latter, whereas the author of this publication has, in April 2023, been a member of a working group to compile the first draft of university regulations about using AI chatbots in the courses [27]. Instead of total prohibition (out of control of the faculty), these regulations encourage the usage of AI chatbots in classrooms, focusing on purposeful application and thorough reflection of the application of this technology. AI-assisted writing can provide a coherent, albeit somewhat technical and stilted output with plausible-sounding [21, p. 5] yet fake references [4, p. 1122] called hallucinations [28]. Therefore, even when using AI chatbots is allowed at universities, severe caution must be exercised to avoid any academic misconduct – or, at least, this is the advice by the faculty members and university administrations [24–26].

There are but few studies focusing on students' own perspective of using AI chatbots for home assignments [21], and even less focus on using text-generating AI software from the LIS perspective. To some extent, it is possible to draw parallels from the previous studies on using Google for information searches: for example, the similar veil of opacity shrouds AI chatbots in terms of using various resources and generating the output, or at least at first glance, using AI chatbots demands new skills of making a query as a prompt for the chatbot. However, AI chatbots' capabilities seem even more powerful than ones of the ubiquitous Google. The text-generating AI software is often presented as a 'buddy' or a 'partner' [29] that can produce text quickly, helping to break the writer's block [21, p. 6]. It can help out by formulating ideas [21, p. 6] or even start dictating the contents of the student's essay [21, p. 6]. Unlike a human buddy who can be hesitant or confused, AI chatbots can produce plausible-sounding content [21, p. 5], [4, p. 1122] – even if it contains false claims or references, as mentioned above. For students who are not entirely aware of these problems, any AI chatbot can look like a powerful ally despite its flaws. Yet, when using AI chatbots, the ability to understand the process of information creation in these kinds of platforms [11], and to "transfer knowledge of capabilities and constraints to new types of information products" as presented by ACRL [30] has particular importance. Hence the rhetorical question in the title of this article: "Is information literacy still needed?" and the necessity to tackle information literacy in the context of using AI chatbots from the students' perspective. Two research questions guide the current study: Firstly, how do students reflect upon the usability of AI chatbots in terms of searching, evaluating, and presenting information? And secondly, from the students' perspective, what are the benefits and problems related to using AI chatbots in the process of writing?

3   Methods

This paper focuses on an intervention of inviting students to use AI chatbots in the process of writing short literature reviews. Writing a short literature review has been an established task to support students' IL skills in two curricula (the applied higher

education program 'Information Management' and a bachelor program 'Information Society and Social Well-being') during the 'Information Behavior Theories and Practices' course at the University of Tartu. The course was designed in consideration of the academic progress and needs of the 2nd year students. During the spring semester of the 2022–2023 academic year, this task was enhanced by adding a request to use some text-generating AI software (such as OpenAI GPT-3 Playground, OpenAI ChatGPT, Copymatic AI, or others) in the writing process and to reflect upon using the new technology. Only the reflective assignments, containing students' responses to the reflection questions about using text-generating AI software, have been included in this study.

During the introduction of this assignment, the usage of students' reflective assignments in research was covered, including the possibility to opt out at any time without any negative consequences. As the present study did not involve sensitive personal data, no ethics approval was required. As the reflective assignments were gathered in the framework of a course, it is not possible to grant 100% anonymity to the students who participated in this study – even if, for the analysis, all the names of students were removed from the files of reflective assignments, it is still a theoretical possibility to check the list of course participants during the given semester. However, for the sake of confidentiality of the students who participated in this study, I refer to the reflective assignments only by assigning each assignment a number (marking the reflective assignments as 'R1', 'R2', etc., from 1 to 26, as 26 students in total agreed to contribute their reflective assignments for this study), instead of referring to students based on their curriculum or course.

The students wrote their reflective assignments based on ten reflection questions. By the beginning of the spring semester 2022–2023, [21] had published helpful preliminary ideas about what kind of questions to ask, but the paper was more focused on the recognizability of GPT-2 in students' assignment and ethics of using chatbots in academic writing. Therefore, not all questions were applicable to the current study. The questions adapted from [21, p. 4] were: How easy or not was it to write with the aid of artificial intelligence? What worked well and what seemed problematic when generating a text with the aid of artificial intelligence? How did the AI-generated content affect your thoughts? To what degree is this paper your writing? Do you expect a reader would notice text produced by the artificial intelligence versus your own – what would help her in this case? Would you use this tool again, and in what circumstances? I added some new questions to the list: as the students could choose a freely available text-generating AI software, they first needed to state which one they used. Then, they needed to describe the prompts used when interacting with the AI chatbot. As previously, all students had passed at least one course about information search in the academic databases, I included two questions about comparing their information search experiences with academic databases: considering the principles of information search they had learned so far, what was different and what was similar in the process of writing a short literature review when using the chosen AI chatbot?

The students' reflective assignments (n = 26) were analyzed using inductive thematic analysis to identify themes related to using AI chatbots in the academic writing process. I conducted the analysis using a sociomateriality perspective with the focus

on students' reflections on a tool (the AI chatbot) being used within a particular practice which is in turn shaped by the same tool [7, 11]. To avoid the pitfalls of thematic analysis, such as a mere collection of extracts from the data, paraphrasing answers to particular questions as themes, or incoherence in themes [31, p. 94–95], [32], I carefully followed the different phases of thematic analysis [33]. After familiarizing myself with the data by close reading and note-taking of all the students' reflective assignments, I conducted open coding across the entire data set. The previously established research questions guided me in structuring the results. However, it was possible to identify the 'key' theme [31, p. 82] based on the perceptions of the role of AI in the writing process, hence extracting the theme qualitatively at the semantic level [31, p. 84] from the students' reflective assignments. As recommended, I drafted a thematic map [31, p. 91] to compare and review the codes and themes, continuously defining and refining them to gain a complete and precise overview of the themes at hand. In the second half of the spring semester, juggling between the process of analysis and other academic tasks provided a necessary distance to revise patterns in data. Finally, by using the extracts from reflective assignments, I produced the report comprising the Results section of this paper. Paradoxically, although the topic concerns one of the latest technologies, the entire analysis was conducted using paper and pencil. AI technology (Grammarly) was later used only for the language editing purposes of this article.

4   Results

It is not uncommon that a thematic analysis yields only one central theme drawing together other minor themes [33, p. 65]. The analysis of students' reflective assignments on the usability of AI chatbots in their short literature reviews also produced a central theme of 'trust, but verify'. "Trust, but verify" is a Russian proverb, but due to geographical and historical proximity also well-known in Estonia. The meaning of the proverb is that even though someone can seem trustworthy, the information received from that person should be 'taken with a grain of salt' – yet in the context at hand, instead of a person, it is the AI chatbot. Thus, it is not surprising that the proverb was also quoted by one of the students; a similar sentiment was often present in reflective assignments, expressed in slightly different ways. In short, 'Trust, but verify' is a theme consisting of evaluations or assessments of particular tasks in writing a short literature review: the assessment of resources and the evaluation of the content provided by AI chatbot, but also the task of verification of the content produced by the text-generating AI software. It appears from the students' reflective assignments that even if not being asked about it, the theme 'trust, but verify' also incorporates an affective component, that is, emotions bound to using the AI chatbots (much like we can analyze emotion in the information search process [34, p. 82]). In the Results section, I will provide an overview of the theme 'trust, but verify,' structuring it in the sequence of the tasks mentioned above and complementing the tasks with reflections on emotions.

Information seeking for the purposes of writing a short literature review did not always begin in the AI chatbot. Some students decided to perform some queries in scholarly databases, then visited the chatbot, yet some started to explore the possibilities of the AI chatbot first. As with the Google search engine, most AI chatbots also have

a simple interface where one can input a prompt and receive an output within seconds. The first emotions (some students were using an AI chatbot first time in their life for this home assignment) were thus generally optimistic: "as if asking from a friend" (R19), "it looks like a life buoy" (R4) were some impressions. The AI, producing the output, also leaves an impression of a "smooth process" (R23), for at first glance, everything looks logical and trustworthy – and after all, who does not like to watch the machine doing the job for a human, getting a satisfying feeling from watching a text automatically appearing on the screen: "I think, what worked well, was that the AI stepped into action immediately. It was so good to watch how it added more and more text" (R6). Therefore, the AI chatbot also got compared to 'Kratt', a magical treasure-bearing creature from Estonian mythology [35]: "I guess, out of curiosity, or when I am stuck with my ideas, I could use 'Kratt' in order to collect some ideas" (R25). As mentioned in previous studies, students do not attend paper mills or AI chatbots for fun; they do it because of exhaustion or overwork: as the saying goes, "a drowning man will clutch at a straw," the AI chatbot was also seen as "a useful straw" (R1) when the complicated academic texts confuse the stressed student (R8).

After the first impressions, students' evaluations of the resources and content provided by the AI chatbot brought a turn of events. The initial optimism was sooner or later replaced by cautiousness and doubts. At least at the beginning of the spring semester 2022–23, AI chatbots did not yet provide in-text citations, which was demanded from the students writing the short literature review. When requesting references to resources, many (18 out of 26) students mentioned in their reflective assignment a discovery that AI chatbots were hallucinating, (i.e., providing them with non-existent or fake references). The lack of transparency: what databases is this information taken from, what are the sources of information, was often mentioned. The AI chatbot seemed to pick articles "at its own will" (R25), and checking the suitability or even the existence of an article became an essential task for students. Comparing the process of providing prompts in AI to the information search in scholarly databases, the students admitted certain similarities (you still have to think of a good query (R2, R5, R18, R21) to 'feel out' the information (R1)). Like the scholarly databases, the AI also provided some serendipitous moments: "The article bearing the same name was published in the 'Digigeenius' [a tech news portal], but the author and publishing date were not the same. However, that article in the 'Digigeenius' matched my topic, and I could use it in my short literature review" (R5). However, the scholarly databases provided mostly useful and quality information during this intervention, while the AI chatbots failed students' anticipations. As expressed by one of the students: "From the [scholarly] database, a blind chicken also finds a grain ['a blind chicken also finds a grain' is the Estonian saying about serendipity or blind luck]. But in AI, I would not be so sure about that blind chicken finding the grain" (R2).

The 'trust, but verify' theme also contained assessments of the content provided by AI. Students noticed some peculiarities in the texts they received: the texts tended to contain very generic thoughts (R2, R18) and repetitions (R2, R4, R17, R25) that were sometimes even not related to their prompts. The texts were described as "stiff and machine-like" (R25), "raw and bumpy" (R1), and "round" (R3). Some students even got the impression that the AI is making things up (R1) or providing false claims: "When feeding it an already existing article, the content provided by the chatbot also might

not be 100% true" (R17). The possibility of providing a prompt in their native tongue (mostly Estonian) and receiving the output in the same language was seen initially as something beyond current possibilities (R18, R19). However, it also appeared that the AI does not always provide good translations, "the sentences [containing words in the Estonian language] sometimes followed sentence structure of English language" (R14). Despite these shortcomings, the students remained optimistic about the purposes of AI. As many of them were in time-stress or tired while writing a home assignment, AI was often claimed to provide new "ideas," "perspectives," or even "inspiration" (R8, R18) to the topic at hand. It also produced ideas for the structure of the short literature review. Even if the translation was not always flawless, AI made complicated academic texts published in a foreign language more understandable and remained a valuable tool for translating small portions of academic papers: arguably, it outperformed Google Translate. Some sense of security, at least in the face of the intention to return to AI when in trouble, remained: "I guess I would use it in the future when I have this feeling of getting very stuck and would need ideas to start with" (R24).

Due to the perceived shortcomings in references and content provided by the AI, the students' reflective assignments revealed an important subtopic, the task of information verification. After understanding the flaws and mistakes in the text, so-called 'fact-checking' was imminent. It became clear that in the case of AI, carefulness must be exercised. Some students checked in Google Scholar whether the publications exist (R4), and revisiting various scholarly databases available for the University of Tartu, was also considered (R9, R19, R22). Some reflected that little experience and contact with the topic of their short literature review made assessing the quality of the content provided by the AI chatbot harder: "Very likely, the faculty members would understand the fact or logic errors that are in the text" (R3). The matter of subjective relevance was raised: "Would I summarize the same points from the text" (R19) – similar considerations were instrumental in the context of the course in general. In some frustration, several students considered the unexpected verification process of AI-generated content time-consuming: "It was disappointing especially because of my very busy schedule, I lost valuable time and could not write much" (R7). In particular, the opacity of AI's choices of publications was seen as problematic, for it would be easier to retrieve relevant publications and write the home assignment by oneself, knowing exactly from which publication or even page the particular piece of information was taken. The need for opacity was vividly explained among several examples: "Compared to usual information searching, it [work with AI chatbot] differs because of its opacity. In order to understand whether the sources I want to use are reliable, I need access to the full texts and information about sources, time, and authors. AI does not present any of this information; it puts the responsibility to assess information credibility on the user and does not provide the entire context" (R18). Furthermore, according to the students' responses, one does not need to check the credibility of academic papers from scholarly databases – the databases can be challenging to use, and reading scholarly papers can take time, too, but at least it is generally possible to trust these resources. Alternatively, as one of the students put it: "These queries [in the AI chatbot] demanded much less effort, but searching from credible databases provides me with relevant articles – I can be sure that these are peer-reviewed and do actually exist." (R4). The careful attitude gained from this lesson can

be summarized as follows: "… But it must be a complete idiot, getting the whole text from a chatbot and presenting it as one's own, without even editing it" (R25).

5   Discussion and Conclusions

The current analysis produced a dominant theme, 'trust, but verify,' from students' reflective assignments about using AI chatbots to write a short literature review. Even if an AI chatbot can indeed resemble a fast and obedient 'writing buddy' or 'Kratt' (that I will discuss later), it sooner or later reveals its dark side in providing confused students with hallucinated references and content that needs to be verified. According to the students' responses to reflection questions, text-generating AI software can be helpful under certain circumstances. For that, the user needs better to know its capabilities and have previous knowledge about the topic 'discussed' with the AI chatbot. The clues from the reflective assignments also provide us with ideas about how to approach text-generating AI software in the context of information literacy instruction [10].

As the analysis of the theme 'trust, but verify' revealed, the attitudes and emotions towards AI chatbots may change as the experience of using AI develops. By relying on the experiences obtained from this intervention, I suggest that from the perspective of information literacy instructors and faculty members in general, it is crucial to overcome the initial blind trust in the capabilities of AI and encourage students using AI chatbots to maintain a critical attitude towards this new technology. Banning the usage of AI chatbots in classroom means that at least some students still explore the possibilities of text-generating AI software – forbidden fruit is sweet – while faculty members need to waste precious time to detect AI-caused cases of contract cheating. The problems arise when the students are not careful enough with the hallucinated references or false claims generated by AI chatbots – simply because of their lack of experiences or subject knowledge. Therefore, the experienced faculty members and information literacy instructors can be perfect academic partners when exploring the potential of, but also flaws generated by AI chatbots. Discussing AI chatbots' affordances in seminars and other peer-to-peer learning settings [9], putting text-generating AI software into use when solving practical or academic problems or tasks, while being clearly instructed by the faculty [36, 37] are but a few examples of how both students and faculty could learn more about application of AI chatbots. This takes us to another research topic to pursue, but while neglecting the developments of AI chatbots, the often over-burdened faculty can easily find themselves "*lagging behind* the younger generation" [8, p. 85] – hence, discussing and testing issues related to AI chatbots in the classroom while learning together could provide some relief in this threat.

Google search engine has been criticized for its opacity and biases [7, 11], yet in text-generating AI software, at least during the completion of this article, the opacity is even more impenetrable. Even when presenting concrete information sources in a prompt, there is still a possibility that the AI chatbot uses some other sources instead, or by mimicking the creativity of human beings, it can try to 'invent' its 'own' thoughts (from author's correspondence with OpenAI Playground). As has been previously the case with the Google search engine, the interface of most AI chatbot applications at the first glance looks simple, easy-to-use tool, and the quick, real-life like appearance of

the response on the screen, as if your buddy is responding to you in some chatroom, only increases the feeling of trust. Nevertheless, while the Google search engine has generally been considered trustworthy by users, [15, 16], invisible, and taken for granted [7, 11], the students' reflective assignments reveal something different after this short experimentation with the AI chatbots. The problems with references and the content itself imply the need to assess the quality of the content – hence, 'trust, but verify' is a dominant theme in this study. The AI chatbots, as part of our information infrastructure, thus become perceptible because of their 'frictions or disturbances' [8] that are so difficult to spot in the Google search engine. Eventually, in case of AI chatbots, more emphasis falls on evaluating the quality of the resources and truthfulness of the content, not mentioning the peculiarities in the text, also pointed out in some previous studies [4, 21]. The selection of resources from the list provided by a scholarly database or Google (both regular searches or searches in Google Scholar) is missing in the AI chatbot: if, in Google, the users do not understand the algorithms behind the search process, they still have some control over the choice of materials (even though users rarely go beyond the first page of the results [7, p. 33]). These 'frictions, ' summed up in the combination of opacity and flaws in AI chatbots, coupled with the perceptible need to verify the generated information equip us with critical questions about checking AI-generated references and content from alternative information sources - students could use these questions in discussion seminars or in their home assignments to try out the capabilities of AI chatbots.

Because of its opacity, it is nearly impossible to understand what values or biases are guiding the algorithms of AI chatbots in providing outputs. So far, we know that InstructGPT (that ChatGPT is based on) is "biased towards the cultural values of English-speaking people" [38], but very likely the biases previously analyzed in algorithmic culture [6, 8] remain. In addition to discussing potential biases within AI chatbots, we also need to consider the cultural differences in its users. A few culturally significant findings emerged from this study: First, 'trust, but verify' itself is a well-known proverb that can be helpful for critical thinking about AI chatbots, as introduced in the Results section. Secondly, in Estonia, a well-known metaphor for AI is 'Kratt.' 'Kratt,' known in Estonian folklore as a creature made of old junk which is 'vivified' with three drops of blood from its maker and can bring treasures. Most likely, the tales of 'Kratt' have traveled to Estonia from Northern Germany, where a similar creature is known as 'Drak' or 'Fürdrak' [39, p. 45]. However, according to Estonian stories, its maker has to continuously outsmart 'Kratt' by providing all kinds of tasks to be completed – without any tasks, 'Kratt' will kill its owner [35]. Therefore, using the 'Kratt' metaphor for AI applications in Estonia still reminds us both the fortunes it can bring and the loads of work it can do, but also of the possible threats it poses to its maker. Both the proverb 'trust, but verify' and the 'Kratt' metaphor can thus be used in information literacy instruction in Estonia or comparative cultural contexts. Or, it can be helpful for information literacy instructors (often librarians with a background in humanities) to think about similar kinds of metaphors that stress that critical thinking. Just as AI chatbots are biased towards the values of English language speakers, many useful acronyms (like CRAP or CRAAP) in information literacy instruction are invented in English-speaking countries, and the exact words behind these acronyms can sometimes be hard to remember for those who are

not native speakers. The stories or sayings that make sense in specific cultural settings may thus contribute to information literacy instruction and critical mindset despite rapid technological developments.

This study was a small-scale intervention of using AI chatbot in the framework of a LIS-specific course. In the context of information searching, the students participating in the course had similar background: they had been previously trained in information search in academic databases. This limitation in the sample leads to possible ideas of follow-up research: either previous knowledge in information search in databases, or AI software could be treated as a variable, to compare more experienced research participants (for example students) with those who lack similar training. In addition, the relatively small number of reflective assignments (n = 26) as part of a bigger homework posed its limits: the data did not yet provide as much depth and detail [33, p. 65] as would be necessary to ensure the quality of thematic analysis. Therefore, I plan a follow-up study with students from the same course, to conduct semi-structured interviews with them to understand better their experiences of using AI chatbots, and to validate the result of the current study. Also, considering the course environment, students were likely aware that critical attitudes in the information search process is encouraged: thus, there is the question of whether the same study participants would be as critical towards AI chatbots in other information seeking contexts, or, when not presenting their thoughts to any other person (e.g., researcher).

This study was conducted in the context of a strongly LIS-specific course, 'Information Behavior Theories and Practices,' that discusses some of the same issues present in this article: the opacity and bias in the information search process, especially in Google. Yet, as stated earlier, much focus in information literacy instruction has been put on 'issues of access, searching, and evaluation of information' [6, p. 1482]. Indeed, the focus of information literacy instruction should move beyond these issues as questions 'How to see through the algorithms of an AI chatbot?' or 'How are AI chatbots shaping academic assignments?' are equally problematic when students write their home assignments in any discipline. Attempts to ban the usage of AI chatbots are futile if it is not possible accurately and quickly determine whether a human being or a machine made the text presented by a student. Therefore, instead of letting the faculty 'play police and thief' (which is time-consuming and humiliating, according to conversations with colleagues), it may be a fruitful exercise to explore and make sense of the AI chatbots together with students – in the framework of appropriate information literacy skills related course.

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Improving STEM Competences by Using Artificial Intelligence to Generate Video Games Based on Student Written Stories

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Abstract. In this paper the results of conducted research as a prerequisite for a model developed in order to foster STEM competences of non-STEM students are presented and elaborated. To provide an effective teaching approach for non-STEM students a model that uses advanced artificial technology has been formed. In this model students learned about STEM subjects by using information technology paired with artificial intelligence (AI). More precisely, students boosted their literacy skills by writing a story to use as a scenario. This scenario had to be structured well-enough to be processed by algorithms based on AI that generated a video game based on a created scenario. This process was based on the gamification method with an aim to support strengthening four different competences: (1) literary competences, (2) writing in a foreign language, (3) coding and STEM skills, and (4) lifelong learning competences.

Keywords: STEM competences · gamification · literary competences · video game

1 Introduction

The increase of non-STEM students' interest for the STEM subjects can be observed due to the growing need for acquiring STEM competencies in a fast-growing technologically determined time and environment. One of the reasons for this could be higher demand for interdisciplinary professions on the market (like videogame engineers and designers) and the increasing number of new AI tools students regularly use or are starting to use. Hence, there are two reasons why the interest for understanding AI and STEM has increased among students. First, they noticed the influence AI has on society. Second, they are also aware of the fact that STEM competencies are required in many cases on the labour market, including in the education system. This opens the issue of prior knowledge needed for the acquisition of such competencies by students who study social studies and who, for the most part, developed other competencies along their educational path. The need for prior knowledge draws attention to the challenge of how to teach/learn STEM content to strengthen those competencies. While most teachers try to find ways of

reaching out to the students they might find instruction more challenging when they are called on to combine content from one field of study with another due to a large number of students that are studying different types of social science disciplines. We conducted smaller scale testing and measured outcomes of various models on a smaller sample of approximately 25 students in a laboratory/exercise class. We based conclusions on a teaching model that used a programming code to transform creative literary content through visual representation. The idea was to create comparative outcomes in a different form in order to achieve parallel learning of those segments. Otherwise, students would not have the opportunity to learn and to detect those parts that are the most difficult for them. Some students, found writing and structuring the text-content difficult, especially in foreign languages. Other students found graphics and design challenging, and for some it was programming. The goal was to gradually and spontaneously create an environment in which, among other things, students strengthened their computing literacy and acquire STEM competencies. Hence, we conducted a questionnaire based on the five hypotheses in which non-STEM students confirmed their initial interest for learning STEM subjects. In this paper, we present and elaborate on the results of research among non-STEM students that preceded the implementation of the teaching model. We describe the model based on, and in accordance with, the survey results. The gamification method we used was designed to foster STEM competences in a non-STEM field of study. We based the model on a comparative approach that combined both literary competences and coding through a visual intercessor that transmitted words into the videogame and the code. We present the results along with the theoretical framework describing the prerequisites for the establishment of the model and its implementation.

2   A Model Based on the Literacy and Competences

With rapid development of digital services and digital transformations in a wide range of disciplines, new challenges have emerged for those seeking to acquire digital skills and gain digital competence [1]. Learning about information technology can be quite challenging for STEM-oriented students, and it is even more challenging for non-STEM students [2]. In early 2015 the European Union (EU) digital competence framework, named DigComp 2.0, aimed to help resolve those challenges in wider society [3, p. 6, 68–76]. DigComp 2.0 identified key components of digital competence in five areas with twenty one associated competence dimensions. This revised version of DigComp 2.0 came to be known as DigComp 2.2 and is illustrated in our conceptual reference model [3, p. 6, 68–76] in:

1. Information and data literacy: describing the ability of an individual to articulate information needs, to locate and retrieve digital data, information and content, and judge the relevance of the content and the source.
2. Communication and collaboration: describing the ability of an individual to interact, communicate, and collaborate through digital technologies while being aware of cultural and generational diversity.
3. Digital content creation: describing the ability of an individual to create and edit digital content and to improve and integrate information and content into an existing body of knowledge while understanding how copyright and licences are to be applied.

4. Safety: describing the ability of an individual to protect devices, content, personal data, and privacy in digital environments and to be aware of the environmental impact of digital technologies and their use.
5. Problem solving: describing the ability of an individual to identify needs and problems and to resolve conceptual problems and problem situations in digital environments.

These areas should be considered in the process of creating models of teaching. In the central place of the proposed model was the individual and, we assumed, according to Information Literacy Standards for Student Learning [4], that the individual had a minimum level of information literacy, in nine standards and twenty-nine indicators. Nevertheless, many research papers indicated that, regarding the technological shift and reflection to education, being information literate was no longer sufficient. The ability to reflect on what one learns and connect new knowledge to previous knowledge or experience required more explicit attention in higher education research [5, p. 85]. According to Zorica et al. the emphasis in most of the needed competences should be on critical thinking, creativity, initiative, problem solving, risk assessment, decision taking, and constructive management of feelings [6].

Spante et al. [7, p. 7] made a systematic review of peer-reviewed articles (Scopus, WoS, ERIC) where digital competence and digital literacy concepts were used in higher education research. The authors discussed the referencing strategies used for the process of developing concepts of digital literacy and digital competences, based on fifty-seven different publications. Most of the analysed studies examined changes in the individual capacities of students and teachers based on the digital competence concept.

3   A Research Overview of STEM in Non-STEM Domains

Gamification as a method describes a social context inhabited by gaming elements such as awards, rule structures, and interfaces that are inspired by video games. Fuchs et al. [8] analysed the role and impact of the gamification method in business and the wider society, suggesting revising the question of re-thinking the method by applying it in a number of other fields. By integrating literacy and creativity fostered by the gamification method, non-STEM students learned about literacy and coding simultaneously and boosted their STEM skills. They got more familiar with STEM aspects by mapping information literacy in the field and their motivation was increased since they were provided with an engaging and assisted environment.

´Oturai et al. [9] conducted a research study regarding the relations between students with high school mathematics backgrounds and their current study programs. They examined various mathematics-related outcomes and expected to find differences between STEM and non-STEM students. This study was important because it was very closely related to the subject of the research we presented in this paper. Their data [9, p.7] implied that students' current field of study (STEM vs. non-STEM) was only related to their perceived subjective value of mathematics but not to their mathematics self-efficacy and enjoyment of mathematics. The finding that mathematics was a significant predictor of students' grades in mathematics-related university courses across fields of study (non-STEM) indicated that an adequate mastery of mathematics can benefit students not only in STEM, but also in other fields of study.

In terms of the context of the size of the class and efficiency, Elif et al. (2021) conducted a study of the influence class size had on academic performance between STEM and non-STEM fields. They used data from a sample of 25,000 students at a higher education institution in the United Kingdom (UK). They found that, based on the first-year undergraduate students in all disciplines, larger classes were associated with significantly lower student grades.

Freeman et al. [10] pointed out that active learning of STEM subjects was most effective in small classes with no more than fifty students. Sriphong [11] created a gamified context for students to learn computational concepts connecting stories, conversation, visual programming, and text-based programming. This combo-design idea was based on the Snap! program and Python code. The concept was performed in the context of blended learning with a resulting positive effect on student learning and classroom environment that increased students' performance on examinations, improved higher-level thinking skills such as analysis and application, motivated creative skills, and provided an interactive F2F and online collaboration [11, p. 276].

In the context of fostering STEM competencies by designing gamification methods, Trisnawawi [12, p. 185] tested early education about blockchain technology by using a hybrid board game. The results showed that students had limited understanding of the proof-of-work consensus mechanism that cryptocurrencies use to verify and add transactions. Their limited understanding had to do with the limited duration of a gameplay, the absence of audio and visual indications in the web application, and a lack of emphasis on the proof of work process during gameplay.

The He study [13, p. 182] explored the impact of digital games on a group of first year engineering students' learning of academic vocabulary at a Chinese university. They analysed data from the participants' pre/post-tests, questionnaires, reflection reports, and writing practice. Their findings showed that: (1) digital educational games effectively improved students' vocabulary learning effect (both receptive and productive knowledge) in both groups; (2) students in the experimental group showed more obvious progress in terms of productive vocabulary acquisition and an increased awareness of the accurate use of vocabulary in writing; and (3) the vast majority of participants favoured Quizlet and would use it themselves and recommended it to others.

Vlahović et al. [14] also developed a model for critical and computational thinking in STEM educational areas. They found that the social sciences, in other words non-STEM areas, were left out of efforts to help students acquire critical thinking skills. This was "due to the relatively more difficult design of, such content, especially in the part of the development of computational thinking" suggesting the importance of the game design that connects interdisciplinary content through a programming language (in this case, Python).

4 Challenges of Artificial Intelligence in Education (AIEd) – A Shift Forward

The presence of AI has been noticeable in many aspects of society and some authors believe that AI has potential to transform education [15].

McMurtrie [16] made the comparison with the evolution from calculators to computers as these tools revolutionized math and science in the past. They predicted that AIEd will become an essential part of the writing process. Sok et al. [17] reminded us of the importance that educational policymakers, educational leaders, and teachers work closely with each other in order to revise the assessment standards to prevent unfair learning evaluations by using AIEd tools to assess students' work. Even though AI was recently mentioned in the negative context of education regarding the challenges of plagiarism the focus should be put on the many positive implications of AI on education especially in the context of creating new environments and methods. One promising result might be an upgrade of instructional design and ability to adjust and modify content and methods to the individual. This could have wide institutional impact due to the integration of three variables: curriculum content, student capabilities, and many elements of assessment. An analysis of scholarly sources [18] showed that AI has indeed been applied in many educational institutions in different ways including in the form of automation of administrative processes and tasks, curriculum and content development, instruction, and students' learning processes. Chen et al. [18, p .75274] discussed the use of AI for instructional purposes in education to improve effectiveness, efficiency, and quality of learning. Their findings indicated that AI fostered the realization of quality, effectiveness, and efficiency in instruction or teaching.

Some authors claimed that the next generation of online education is not dictated by technology but by the academic need to personalise learning together with the efficient automation offered by AI [19]. This is especially true in the context of e-learning due to AI's ability to individually adjust to the learners' and personalise the e-learning environment.

There are many challenges to the collaborative aspect of education. According to Holmes et al. [20, p. 152], an AIEd tool could be used to give students inside the group the opportunity to take on the main role or test the talent. Or, it could monitor collaborative activities, recognizing when students are having trouble understanding shared concepts, and then providing targeted support or involving a virtual agent that actively contributes to the group discussions or makes dynamic connections.

Ouyang et al. [21] saw the role of AIEd through several paradigmatic shifts: 1) AI-directed, learner-as-recipient; 2) AI-supported, learner-as-collaborator; and 3) AI-empowered, learner-as-leader. In Paradigm One (Ibid.), AI was used to represent and direct cognitive learning while learners were recipients of AI services. In Paradigm Two AI was used to support learning while learners worked as collaborators with AI. And in Paradigm Three, AI was used to empower learning and learners took agency of their learning. Paradigm Three called for a system with synergetic collaboration between multiple entities including the learner, instructor, information, and the technology developed to ensure the learner's augmented intelligence.

Kasnecki et al. [22] highlighted the way AIEd models can be used with a focus on how this language models a requirement that teachers and learners develop sets of competencies and literacies for better understanding of the technology and the limitations of such systems.

5   Methodology and the Results of the Preliminary Research

The presented model has already been tested on a small sample of twenty-five students in a higher education social studies programme. To verify obtained conclusions, a more comprehensive research has been conducted on social and art studies at four higher education institutions from three different universities. The sample size of the respondents was N:201; we tested five hypotheses and fifteen associated questions based on a Likert scale ranging from 1 to 5. Statistical results are presented in the tables below.

Table 1. Survey questions and statistics for H1

H1: Students of social studies show interest in the STEM field								
Q	1	2	3	4	5	$\bar{x}$	M	SD
3. How would you rate your interest in the STEM field?	13	23	47	87	31	3.497	4	1.086
4. According to the experience you gained during your studies, assess to what extent topics from the field of social studies are interdisciplinarily connected to those from the STEM field (i.e. statistics, informatics, research part, etc.)?	7	29	57	92	16	3.860	5	1.304
5. Do you consider the acquisition of STEM competencies for those students who study social sciences important?	2	13	55	105	26	3.696	4	0.813
6. If you could, would you like to acquire knowledge and competences in the STEM field?	10	21	22	107	41	3.736	4	1.055

Table 2. Survey questions and statistics for H2

H2: Students of social studies confirm (regarding their research experience) that they have already practised an interdisciplinary research approach by combining fundamental knowledge of their field of profession with the STEM field

Q	1	2	3	4	5	$\bar{x}$	M	SD
7. Have you ever practiced a scientific research approach e.g. by writing a seminar or project assignments during your studies (for example, searched relevant literature, compared multiple sources, surveys and/or statistics etc.)?	14	18	20	69	80	3.910	4	1.217
8. Have you ever during your studies for the purpose of writing a seminar and/or some project assignments used an interdisciplinary approach in combining your field of study with other fields (for example computer science or statistics)	28	29	37	65	42	3.318	4	1.329
9. Please assess the level of importance of an interdisciplinary approach to different fields regarding the aim of strengthening competences for the labour market, (no matter what is your field of study)?	2	6	32	78	83	4.164	4	0.870

The results in the Table 1 indicated that more than a half of the non-STEM respondents showed positive feedback (Q3) regarding their interest in STEM. Fifty-eight% showed positive feedback: (87 respondents/ 43% positive and 31 respondents or 15% very positive). Only 17% showed negative feedback and these respondents were mostly not interested (23 respondents/11%) and not interested (13 respondents/ 6%). On the other hand, in Q5 SD it was obvious that a majority of the students found STEM competences very important for social sciences as well as for the STEM studies. Here, 65% responded that it was important 105 respondents/ 52%) and 13% (26 respondents) said it was the most important. Only 7% (2 respondents) said STEM competences were not relevant r and 6% (13 respondents) said it was mostly not relevant (Table 3).

Table 3. Survey questions and statistics for H3

H3: Social studies students are familiar with and have already used some of the available AI tools								
Q	1	2	3	4	5	$\bar{x}$	M	SD
10. In your opinion, to what extent is artificial intelligence present in different segments of society in general, and business in particular?	5	11	26	133	54	4.194	4	0.697
11. Are you familiar with any of the IT tools/solutions based on artificial intelligence that have been present on the market?	19	27	23	78	54	3.601	4	1.273
12. Have you so far used any of the artificial intelligence tools?	29	–	36	–	136	4.064	5	1.469

The results presented in the Table 2 confirmed that most of the students had some kind of interdisciplinary research experience and only 14/7% confirmed not having any experience at all (Q7). Regarding Q9, most of the respondents stated they found important interdisciplinary approach in fields of science regarding strengthening their competences for the labour market 80% (78/39% mostly agreed and 83/41% strongly agreed).

Most of the students (Q10), 79% (133/66% plus 26/13%) thought AI had a strong presence in different segments of society in general and in business. One hundred and thirtysix (68% of the students) claimed they had already used some of the AI tools (Q12).

Table 4 Survey questions and statistics for H4

H4: Social studies students rate their programming knowledge as completely unsatisfactory								
Q	1	2	3	4	5	$\bar{x}$	M	SD
13. Have you ever written a piece of programming code in any language?	72	–	20	–	109	3.368	5	1.866
14. During your K-12 education have you ever attended any IT course/s regarding any programming language?	19	17	37	92	36	3.542	4	1.161
15. Please rate your programming knowledge	34	47	69	42	9	2.726	3	1.108

The results presented in the Table 4 showed that 72 students of 201 (36%, Q13) had no experience in coding in any programming language and 17% (Q14, 19 students) and 17 students/ 8%) never attended any IT course. Only 9/ 4% (Q15) of the students rated their programming knowledge as high.

The results presented in the Table 5 indicated that students would be more open to the new knowledge from other fields if they would be presented and adjusted to their field of study. Sixty-five % of the students stated that they would be interested in attending that kind of course (Q16, 88/44% mostly affirmative and 43/21% strongly affirmative).

Table 5 Survey questions and statistics for H5

H5: Social studies students show interest in learning programming if the content and teaching methods are tailored for social studies

Q	1	2	3	4	5	$\bar{x}$	M	SD
16. If I could, during my studies, have the opportunity to enrol IT courses to acquire programming knowledge designed in accordance with the knowledge of social studies students, I would gladly attend them	16	10	44	88	43	3.656	4	1.112
17. If you were given the opportunity to convert your texts into a computer code that would enable you to see the result printed in the form of computer code animation, do you think that this would increase your interest in learning programming?	13	12	59	64	53	3.656	4	1.123

6 Gamification Model

The idea of this model was that students learn about STEM subjects by using information technology paired with AI. Students would boost their literacy skills by writing a story to use as a well-structured scenario. They would use the scenario to generate a video game as an output of their text made by AI and with parallel output of programming code generated by the AI (Fig. 1). This process was imagined as a gamification supported by OpenAI Codex, a tool to strengthen four different competences:

1) literary competences
2) writing in a foreign language
3) coding and STEM skills, and
4) lifelong learning competences.
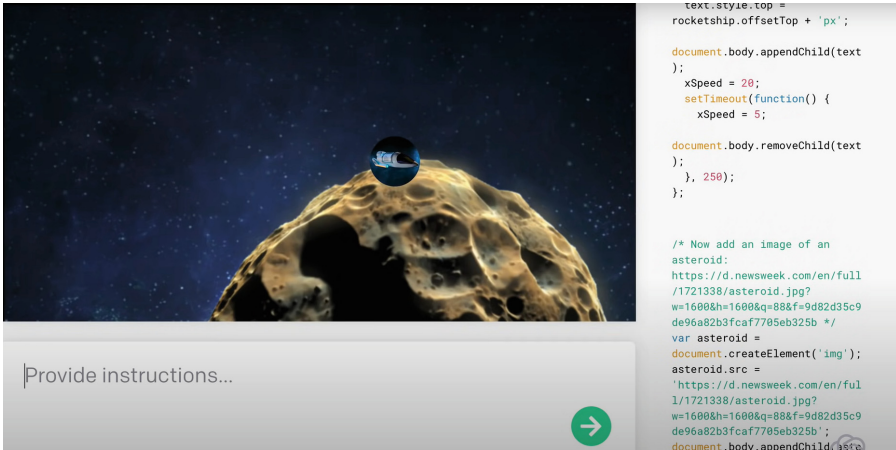
Fig. 1. Game design empowered by Artificial Intelligence (Source: OpenAI Codex)

The goal of this model was to create comparative outcomes in a different form in order to achieve parallel learning. Parallel learning was achieved by writing and structuring the text-content (in the foreign language) from which AI created a visual environment. This showed students how the code in back-end had been created to support the desired scene visual presentation (Fig. 2).
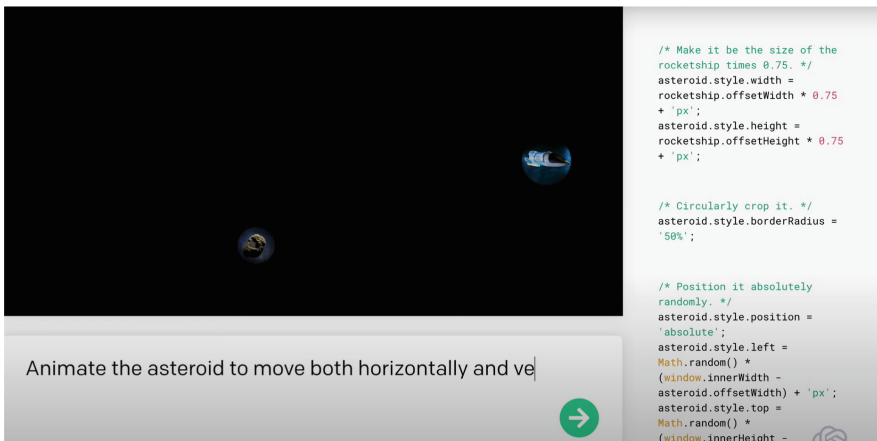
Fig. 2. Example of writting scenario in the text editor - game design empowered by AI (Source: OpenAI Codex)

The application of the model took place over several iterations in which students used parallel tables with two columns to copy and paste the results for the purpose of further assessment. In the left column, students wrote their scenario (the content they planned to test) for each iteration they conducted. We recommended that instructors suggest to students that they use short forms that they could test and maybe improve in further

iterations. Before the application began, the teacher demonstrated a few examples. In the right column, students copied and pasted the programming code that OpenAI Codex wrote according to the scenario they designed and entered. A minimum of seven iterations of performed scenario would be enough for one class for the teacher to be able to analyse and describe some elements of code.

7 Conclusion

AI is a fast-developing technology that has the potential to change not only many aspects of business and everyday life, but also education. In this paper we shared research results that involved non-STEM/social science students' interest in STEM skills along with their current experience with AI tools. Experience with these tools was a prerequisite in devising a model of learning STEM skills by utilizing AI tools to convert student scenarios into working video games. Students stated that they were interested in STEM skills, especially if these skills were tailored to fit their primary professional focus. This conclusion made creating a STEM skills educational model a promising platform for making STEM skills available to non-STEM students. By utilizing this model, students learned more about both structured writing, literacy, and coding at the same time. More extensive research about using this model will be part of future research.

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Artificial Intelligence and Information Literacy: Hazards and Opportunities

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Abstract. While the technical definition of "artificial intelligence" is contested and generally refers to groups of different technologies, what is clear is that as of 2023 a new era of generative AI technologies has begun. AI systems have passed medical licensing exams, won art competitions, and are used in commercial applications to treat mental illness. This conceptual paper will explore the costs and possible benefits to such advanced technology with an emphasis on finding the most useful questions for information literacy (IL) professionals to devote precious time, resources, and energy on tackling. The time to develop the most pressing questions is now given the speed of AI development.

Keywords: Artificial Intelligence · disinformation · pedagogy · IL theory

1 Introduction

Artificial intelligence (AI) technologies have existed since the 1950s [1]. While the technical definition of "artificial intelligence" is contested and generally refers to groups of different technologies, what is clear is that as of 2023 a new era of AI technologies has begun. Powered by increasingly powerful hardware as well as innovative neural networks called transformers, recent large language models (LLMs) have passed the United States Medical Licensing Examination [2] and a simulated version of the "Uniform Bar Examination with a score in the top 10% of test takers" [3]. Neural networks and LLMs are both subsumed under the concept of "machine learning," one of a variety of different computer science concepts attempting to achieve performance on tasks comparable to that of humans; hence, "artificial" intelligence.

Library and information science (LIS) professionals are currently exploring AI tools like Elicit.org and scite.ai as new ways to search across 175 million open access resources including articles, book chapters, and datasets. AI tools like rayyah.ai are beginning to assist with more in-depth tasks like systematic reviews. There is also emerging research providing suggestions for how to use recent LLM chatbot technologies in academic libraries, for example, to assist users navigate a library website [4]. It is integral for the LIS field to investigate the possible use cases for this emerging technology in ways similar to how it adapted to a radically new and transformative technology like the internet.

Yet this should not be our entire concern either. This paper will argue there are larger issues to consider including how LLMs "learn," how they have been used in the past by powerful entities, and the risks of their use and widespread adoption. To properly understand how new AI technologies can ethically, and meaningfully, be used by information literacy (IL) professionals requires us to investigate the broader context of AI history, policy, and ethics.

These concerns must be also balanced with the potential for radically, and positively, changing the world. AI systems can create images and video at such high quality they have won art competitions igniting debate about the intersections of AI technologies and art, authorship, and copyright. [5]. In 2021 an AI program discovered the 3-D structure of 350,000 proteins—where previously uncovering one 3-D model would take months, years, or even decades [6]. AI is currently being used to treat mental illness with just one company's AI treating over a million and a half people using techniques based on cognitive behavioral therapy [7]. The potential for AI to transform education, healthcare, art, and other aspects of society writ large is dizzying. In one sense it is an extension of internet technologies bringing more computational power to the massess at lower and lower cost.

To help create AI technologies that are transparent, reliable, and safe will "take a village" [8] and this includes information professionals. It will be this paper's contention that IL theorists and practitioners are uniquely positioned to lead and facilitate important discussions concerning AI technologies as we have experience and expertise at the intersections of information, technology, and human behavior. However, existing IL theory, practices, and research are not currently adequate to address the challenges new developments in AI pose. To develop theory, practices, policy, and effective research agendas requires developing and asking the most important and pressing questions. It is the main aim of this paper to begin to develop these questions that will guide work at the intersections of AI and IL.

This conceptual, exploratory paper will discuss some of the costs of developing and using such AI technology as well as potential benefits and describing avenues of action for information professionals to take as the rate of growth and use of AI technologies is likley to grow in the near- and medium-term. While limited in scope and depth, this paper attempts to elicit some of the most pressing questions for IL theorists, practitioners, and educators to consider with this increasingly important technological advancement.

2   The Costs of AI Systems

A research group from Stanford recently declared that "[o]ne of the most pressing dangers of AI is techno-solutionism, the view that AI can be see as a panacea when it is merely a tool" [9]. The perceived aura of objectivity and super-intelligence can have large, serious implications for how much trust we put into these systems. It does not take a particularly imaginative person to conceive of a world where we put too much trust in increasingly powerful AI systems. There are already many instances of AI systems being used in business for hiring, banking for loan applications, and the criminal justice system to determine prison length [10, 11]. The city of Chicago used AI to create a "strategic subject list" analyzing people who have been arrested and their likelihood of becoming

repeat offenders, arguing this would improve various outcomes desirable for residents and local governments alike [12].

These examples display what may be the worse aspects of AI technologies: humans trusting opaque AI systems with consequential decisions when it is unclear what data were used to inform the systems' output or how the system came to a decision. This is further complicated by the fact that there is strong evidence for machine learning algorigtms perpetuating existing sexism and racism in various ways [13, 14]. Such concerns elicit important questions for LIS professionals and many others in considering how AI systems are used, such as how transparent do such systems need to be? And in what ways are current systems like ChatGPT accountable for what they output?

2.1 Large Language Models' Epistemology

As of 2023 the most advanced LLM available to the public, ChatGPT, can be as 80% factually accurate in it's statements as measured internally by the company owning ChatGPT, Open AI [3]. This accuracy depends on the subject matter and the exact methods and assessments used to determine this have not been made public, yet this metric is plausible. The other 20% or so of the time (this number is subject to change over time) ChatGPT and other LLMs present inaccurate or made-up answers as true. This is called "hallucination" in computer science terms where an AI system's text output is wrong or untrue but presented with the same authority and confidence as other output [3]. LLMs, while powerful, do not "understand" the concept of truth:— that what they output can, or cannot, correspond to the real world. Such AI models are simply trying to predict the next set of words or characters in a long string of words, characters, or numbers. They are predicting what a human user wants to see. They have no conception or ability to understand the meaning of the words they are outputting. As one noted AI researcher recently stated "What the large language models are good at is saying what an answer should sound like, which is different from what an answer should be" [15].

What is so powerful and unique about such AI models is their ability to predict hundreds or thousands of words in a row. What emerges out of this ability appears to be that the AI understands various topics ranging from quantum mechanics to mathematical reasoning. Yet, the same ingenious techniques that create text that appears "remarkably human" can also become automated to "generate misinformation at unprecedented scale" [16].

What makes hallucinations a genuine problem rather than an annoyance is the certainty with which ChatGPT and other models present their text output. ChatGPT can easily be manipulated to make scholarly citations and work out of whole cloth as there are entire websites like jailbreakchat.com devoted to creating clever prompts such that ChatGPT outputs text that OpenAI attempts to restrict like political or health misinformation. Furthermore, the complexity and architecture of certain AI technologies makes it very difficult, if not impossible, using extant techniques to fully understand why AI systems output certain text. This is the so-called "Black Box" problem where an AI system, such as a deep neural network, is so complex even the creators of an AI system or expert computer scientists fail to fully understand how AI systems make their decisions or why they output X instead of Y or Z [17]. The antidote to this opacity is "explainable

AI," creating AI systems that are understandable by humans. Some experts believe this may even not be sufficient for safe and reliable AI systems [18].

Functionally, we currently have AI systems that appear to be super-human in intelligence and will present text output with convincing authority and confidence. Yet these systems are still only accurate, at best, 80% of the time and they have the ability to make information up and present it as coming from a super-intelligence. As AI systems are perceived to be more and more powerful, their "hallucinations" become more and more dangerous as the trust placed in such systems will, inevitably, be misplaced [3]. To their credit OpenAI has openly discussed this as an issue, stating that AI hallucinations "can lead to the degradation of overall information quality and further reduce veracity and trust in freely available information…" [3].

It is plausible for one to argue such a situation is unlikely or the threat overblown. Academics, politicians, and the general working population have a working equilibrium of sorts with technology. Technology is viewed as useful but when it ceases being useful it is discarded. Websites that do not present accurate information over the long term are discarded in favor of more reliable websites. Yet, one could reasonably argue that the United States' first genuine encounter with advanced AI systems, via social media platforms, continues to be a disaster for certain segments of the population, such as adolescents.

While the relationship between social media and mental illness continues to be investigated, there is evidence to suggest some form of causal relationship between social media and negative mental health outcomes [19]. Teen girls in the United States who "persistently felt sad or hopeless" increased from 36% in 2011 to 57% in 2021 and 30% of this same demographic seriously considered attempting suicide in 2021, up 60% from ten years ago [20]. These studies suggest that neither parents nor teenagers (whose brains are not fully developed) have corrected their behavior in response to research findings indicating relationships between social media and negative mental health outcomes. Additionally, this phenomenon is international with comparable effects found in the UK, Canada, Australia, and New Zealand [21].

Functionally we have the appearance of super intelligence but in fact the epistemological foundation of ChatGPT and other comparable LLM AI programs is solely based in language, not in referring to reality or the world. It is not difficult to imagine a world in which individuals, scholars, researchers, voters, and various other groups place too much trust in AI outputs without proper oversight, skeptical evaluation, and understanding of why an AI output one answer over others. In other words, there is a lack of transparency about how an AI works. This is a reasonable concern given the existing evidence of harm brought by AI systems. Social media, powered in part by AI systems, "has contributed to mental illness in teen girls, the fragmentation of democracy, and the dissolution of a common reality" [22].

We are only beginning to understand the true cost of using AI systems that are so computationally intensive. For instance, the Stanford Institute for Human-Centered Artificial Intelligence estimates that Chat GPT-3 releases hundreds of tonnes of CO2 [23]. We also know that such systems require "human-in-the-loop reinforcement learning (RLHF) and OpenAI paid workers in Kenya less than $2 per hour to remove toxic content from training data [24].

A 2020 Pew Research survey found that almost half of American adults "stopped discussing political and election news with someone" [25], evidence for the poor state of political discourse in the United States. Devoid of oversight and critical examination the use of new generative AI systems could be comparable to the outcomes of social media where large companies leverage human psychology for profit motives at the potential cost of harming mental health en masse, worsening political discourse, further complicating how to find reliable information on healthcare or finances, and so on.

What is an appropriate cost to benefit ratio for AI systems? How can we ethically weigh the benfits of individual use versus the potential for collective harm?

2.2 State Actors Weaponizing AI

AI technology can, and has been, weaponized. The greatest near-term threat with emerging generative AI technology may be in driving down the cost and difficulty of creating vast quantities of mis- and disinformation. It is currently not difficult for widely available AI chatbots to spew vast quantities of disinformation on topics ranging from "vaccines, COVID-19, the Jan. 6, 2021, insurrection at the U.S. Capitol, immigration and China's treatment of its Uyghur minority" [26]. This is a major challenge as "information overload leads people to take shortcuts" in deciding on the trustworthiness of information [27].

Imagine a world in which advanced AI systems can create massive amounts of text information in the form of news articles, audio in the form of podcasts, and deep fake videos, in such convincing ways such that it becomes difficult to discern AI-generated content from human-generated content. A state-actor could easily finance such an endeavor right now as of 2023. Not with the goal of spreading falsehoods but to attack the very idea of being able to ascertain what is true from what is false. The epistemic foundations of a free and openly available internet, of democracy, would be at stake if reasonable citizens would not be able to easily differentiate between the 'truthful' signal from the copious and malicious noise. Trust in public institutions would be eroded meaning the news media, public health officials, and experts could all be discounted.

One could argue this is an ongoing effort in Russia to bolster public opinion in support of the Russo-Ukrainian conflict. Russian propaganda outlets do not need to spread outright fabrications (although they do on a regular basis), only to present a plausible counterpoint to factually accurate reporting. The net effect of this type of information warfare is both to present a specific viewpoint on the conflict but also to erode the notion that an individual can ascertain the truth of the conflict. One RAND report labelled this strategy as "Russia's firehose of falsehood" [28]. One independent poll commissioned by CNN right before the unprovoked invasion "found that 50 percent of Russians said it would be 'right for Russia to use military force to both prevent Ukraine from joining NATO…and if it feels threatened by foreign activity in former Soviet countries'" [29]. Advanced AI chatbots are not needed for this type of propaganda and information warfare. Yet, such systems could refine such efforts to conduct information warfare activities both at home and abroad. While there is no publically available information regarding Russia's use of LLMs during this conflict, it is plausible to think that they, or other belligernt nation states, could see the value of spreading mis- and disinformation much easier, faster, and cheaper than using human propogandists.

It is difficult to discern how much an effect this type of information warfare would have on, say, European support for Ukraine or the next Presidential election in the United States. It is reasonable for some individuals to find such an explanation to be a far fetched and some scholars have shed doubt on just how effective misinformation is on public opinion, arguing instead that it is more likely individuals are uninformed than misinformed [30]. It is also fair to say that propaganda and information warfare have existed for far longer than AI.

Yet we have a clear track record of authoritarian governments using AI in utterly malevolent ways. China has used it's "Sharp Eyes" program to keep track of its own citizens, "matching video images, social media activity, online purchases, travel records, and personal identity into a "police cloud"…becoming "the world's leading AI-powered surveillance state" [31]. The U.S. State Department has labeled the actions of China towards it's Uyghur minority "genocide [32] with the UN claiming that China's actions may be "crimes against humanity" [33]. It would be naive to think of China as using previously available AI technologies to subvert their own population and commit likley henious acts against humanity but not use generative AI technologies to advance their political, military, and economic agenda both at home and abroad.

Important questions remain. What is gained by providing such a powerful tool to adversarial nation states by making it available, for effectively free, online? Are there models of potentially dangerous or innovative technologies that we can follow to allow the use of these technologies to thrive commercially yet work towards desired goals like improving civic discourse, addressing the climate crisis, and assuage income inequality?

2.3 Advocacy for Regulation and Transparency of AI Systems

This does not mean information professionals, educators, and others invested in a free and open democratic society where people can find and use reliable information are without recourse. There are very real ways IL educators can help advocate for more transparent and regulated advanced AI systems. The American Library Association, Canadian Librarian Association, the Chartered Institute of Library and Information Professionals, and other organizations can lobby local, state, and federal governments to regulate aspects of advanced AI systems to make them more transparent and reliable and —to lobby for effective oversight to ensure that an individual company's profit motive does not endanger the public trust in freely available information. It is worth noting that such efforts have been successful in other potentially dangerous research areas like nuclear weapons, biological research, and so on.

Information professionals can also advocate for open source LLMs as opposed to for-profit language models developed by for-profit companies. The current status of AI research and development by for-profit companies is a race for marketshare where billions of dollars over the coming decade are up for grabs. This is not a structure conducive to thoughtful and critical development of such transformative technologies. It invites transgressing previously held AI safety principles like not connecting AI systems to the internet and avoiding teaching AI systems to code in ways that it could eventually modify it's own code. Again, there are previously held models like the open access and open educational resources movement for information professionals to draw from.

While this will likley be an uphill effort lasting a long time against powerful state and corporate interests, it will be far easier to advocate collectively than individually. Instruction in the college classroom is likley insufficient to address some of the biggest challenges AI systems pose for free and open societies. Academic librarians and other similar professions have the unique experience and opportunity to hold inter-disciplinary conversations with instructors, students, university administrators, and other relevant stakeholders.

There will be opportunity costs. We must ask ourselves: ought we spend precious time and political capital to advocate for safe, transparent, and and reliable AI systems? Are we willing to forego advoacy in other areas?

3   AI and Pedagogy: Possible Benefits

AI is no stranger to higher education. The debate about learning analytics, for instance, has been ongoing since universities first began collecting and using large datasets about student success metrics, enrollment, and so on [34]. As it pertains to the newest advances in AI. We shall focus on the two most pressing issues facing the learning mission of institutions of higher education: academic integrity and helping students learn about the contours and limitations of artificial intelligence systems.

3.1   AI Opening New Avenues for Student Learning

There is some concern about the value of a diploma if a student, using a free or relatively inexpensive artificial intelligence, can complete take home assignments. Some majors are replete with writing assignments with which ChatGPT and other systems are gaining increasing skill in completing. This is a fair concern, but I will argue it is not nearly the most important question to consider for IL practitioners and educators. As Fister and Head point out tthere was similar alarmism with other novel technologies like Wikipedia [35] and after a short amount of time instructors were able to navigate this new resource for students. Common pedagogical strategies, assessments and other instructional design tools to effectively assess student learning will be developed, copied, and employed. It is more likely this will be a disruptive force in the months and years ahead but not a revolutionary one.

Furthermore, the ability to use another's work as one's own has been consistently available for students in a variety of contexts in the past ten years. Most obviously, students can pay other individuals to complete their assignments and this has not seriously impacted literature departments. Code repositories like GitHub have not destroyed computer science education. Calculators have not decimated mathematics or physics education. While AI is certainly of a different quality than these previous technological advancements, it is more likley than not that instructors will find, and share, ways to manage the fact that advanced generative AIs exist.

Yes, the moral hazard for academic misconduct is higher with advanced AI systems in the world but educators are adaptable. It is not particularly challenging to consider different learning activities, assessments, and technologies to encourage academic honesty. Moreover, there is no guarantee that AI detection tools will keep up with generative AI

technology. It will be a cat and mouse game and educators cannot rely on AI detection tools to be 100% accurate. It appears to be a fools' errand to focus on cheating detection rather than on instructional design to avoid the issue in the first place.

The more important pedagogical question to consider is this: what can we accomplish with AI? Again, AI technologies are rapidly evolving, and the future is unclear, but it appears reasonable to assume that generative AI will soon become enmeshed into everyday life like cell phones and the internet. Imagine an AI system that sidesteps issues of accuracy and reliability and instead specializes in encouraging metacognition and deep reflection. When a student feels frustrated an AI chatbot could encourage them to look at a problem in a new way or to skip a problem and come back to it later. It could prompt the student to consider how they eventually arrived at the correct answer, building feelings of competence and mastery. There already exists "private" open-source AI systems that require no connection to the internet and so this system need not be intrusive or share data of any sort.

This would be a technological solution to Bloom's 2 sigma problem. This is where a student tutored one-on-one performs two standard deviations better than students in a classroom where there is a 30:1 student to instructor ratio [36]. Bloom's solution involved developing group-based learning that is as effective as individualize tutoring. AI technology could potentially offer an alternative approach. To be clear this is pure conjecture but the potential for improvement in student learning outcomes is plausible with AIs that help students achieve greater metacognition or function as a caring and supportive tutor.

Consider an AI system that can clean data or write code without extensive background knowledge on these tasks. So called "low-code" applications paired with generative AI systems allow individuals to write code and develop programs and apps far more quickly than previously done [37]. Fewer technical hurdles to cleaning data, writing code, and developing apps could mean students spend less time worrying about the technical aspects of certain assignments and more on creativity output, interdisciplinary projects, and higher-order thinking skills rather than spending time troubleshooting bugs in a code or cleaning data manually.

3.2 IL Theory, Pedagogy, and AI

The most important and creative IL theories of the past ten years have sought to contextualize information. Gone are checklists and simple actions like checking to see if information was peer-reviewed or retrieved from a library website. IL theory now dictates to investigate one's information landscape. Open data repositories (many of which are managed by academic libraries) can provide students with meaningful data to analyze. Open educational resources not published through traditional means can be better than those sold by major companies. IL theory has responded in part to the dynamics of the information age through progressing away from linear thinking to considering aspects of authority, drawing on theory and methods outside of library and information science, and investigating intersections of information and power, race, and gender.

New AI technology may upend the scholarly or public information landscape just as the internet, web browsing, and online search did. Some scholars argue new AI chatbots like ChatGPT are akin to progressing from basic rifles to machine guns [38].

The sheer increase in the ability to create large quantities of text makes such AI systems qualitatively different than other technologies. This means IL theory must adapt, grow, and respond to this emerging AI technology just as it did with e-books, the internet, cell phones, and so on.

The potential to make contributions to both practical applications like pedagogy and to existing computer science problems is vast. Consider the "black box" problem again where neither computer scientists nor the user can explain how a neural network or other machine learning AI produces a particular output. Let us say we train an AI to account for certain biases. Given the complexity of the AI and our inability to understand where and how it "thinks" or "makes" a decision, how are we to be sure that such a system is not perpetuating this bias even further but more subtly [39]?

What if certain IL theories were amended to account for vast quantities of AI-generated text, images, and videos? This in turn could shape how IL professionals teach IL in classrooms or engage with the general public in ways similar to how we draw distinctions between open-source materials, use institutional repositories, and help students to use information in more sophisticated, intentional, and ethical ways.

Rather than teaching students who may be uninterested in the technical components of neural networks information, professionals could discuss the incredibly large amounts of data required to train these models. Where did this data come from? Who provided consent to use this data? Learning activities concerning the use of reinforcement learning with human feedback could also be created to highlight how humans are still required to curate an AI's text output, dissolving the myth of AI "learning" by itself.

In what ways does IL theory need to adapt to this new technology? While keeping in mind the various shortcomings of AI systems, how could IL professionals use AI in ways conducive to innovative teaching and learning? How could we help create the next generation of democratic citizens who will need to use AI technologies responsibly, ethically, and intentionally?

4   Conclusion

AI technology is a tool, not a panacea and AI systems have existed for decades. Society has already encountered advanced AI through social media, facial recognition software, etc. and the results are less than desirable. The newest generative AI systems are more powerful still and may evolve and change much more quickly than previous AI technologies. It is imperative as LIS professionals and educators that we are clear-headed about the risks and opportunities before AI likley becomes ubiquitous in higher education, healthcare, politics, and various other dimensions of society.

To help create and encourage AI technologies that are transparent, reliable, and safe is a worthwhile goal for all information professionals. It is integral we work on this subject now as the speed with which AI develops may outpace that of any previous technology. The time is now for IL professionals to engage with the questions, concerns, and benefits AI presents to us. Academic librarians are uniquely positioned to create meaningful learning experiences, address serious problems AI poses in free and open societies, and develop IL theory to help create foundational principles and concepts in times of great change. Before we debate and research the right answers, we must first

ask the most essential questions. It was this paper's aim to provoke discussion about what these questions should be.

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Data literacy and Digital Literacy

Telling Data Stories, the Way Averroes Wrote His Commentaries – A Three-Level Approach to Facilitate Data-Driven Decision Making

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Abstract. Data stories are a narrative format that presents information and data in a way that is easy to understand and engage with. They contain various elements that need to be considered, including the data, the visual form, and the narrative component, to drive behavioral change and lead to a call to action or an adaptation of the mindset. They can promote data literacy and help people understand and make sense of the data that shapes our world at different levels. We propose a pragmatic heuristic that separates the data from possible narratives and adapts it to three audiences of different expertise and age. The method was developed in two projects dedicated to data stories.

Keywords: Data stories · data literacy · data visualization

1 Introduction

Data stories are a way of presenting data and information in a narrative format that is easy to understand and use. They can be used to promote information literacy by helping people understand and critically evaluate data and its sources. They can also be used to help people be better informed by helping them understand and make sense of the data that increasingly shapes our world.

Following Averroes' principle of writing three general types of commentaries on Aristotle's works, namely literal, metaphysical and political, we propose a similar methodology that separates data from possible narratives and allows data literacy to be promoted at different levels by adapting it to different audiences in terms of expertise and age. This implies that the impact of data stories on data literacy varies depending on the audience, the type of data, and the way the story is presented.

We have explored this topic in two projects carried out by the Information Science Department of the Haute Ecole de Gestion, HES//SO-Geneva. With the VIDAS (VIsual-isation of DAta Stories) project, we delivered a comprehensive comparative study on the

distinctiveness and objectives of data stories [1]. In the MIDAS project (MIcroclimate DAta Stories), we then put the concepts into practice and developed on the basis of two (collections of) data sets three data stories respectively for three different levels of comprehensiveness [2], targeting in both cases scientists, policy makers and/or the large public and finally children.

We began our study with a thorough review of the literature to find a clear definition of the term 'data story'. According to this definition, data stories include different types of elements that need to be considered when telling a story: the data, the visual form and the narrative component. The balanced combination of these elements, through the integration of a narrative into the data presentation, should bring about a change in behaviour and ultimately lead to a *call to action or an invitation to change the mindset*.

Our hypothesis is that data stories can be used to help people make informed decisions by providing them with a clear and concise representation of the data and helping them understand the implications of different choices and make decisions based on evidence rather than intuition. We also think that it is helpful to apply the Averrosian principle of commentaries and to develop a threefold approach of telling stories that is adapted to the needs of different types of target audience.

2   Context

Raw data does not allow for an easy understanding of a subject. It is composed of a large quantity of numbers and symbols that humans are not able to interpret by their own means. Visualization allows us to make the data understandable. Indeed, "Data by itself, consisting of bits and bytes stored in a file on a computer hard drive, is invisible. In order to be able to see and make any sense of data, we need to visualize it" [3]. The literature highlights the important role of data visualization and its impact on the human brain. Strecker [4] points out the essential aspect of data visualization for communication. As the number and volume of data increase, so does the need for better control and understanding of that data. As far back as the 1970s, Richard Saul Wurman foresaw the anxiety that could derive from the complexity of deciphering countless amounts of data and attributed to information architecture the goal of creating a bridge between data and knowledge [5]. This need for data intelligibility is bound to become more important in the future.

According to Lupi [6], projects and opportunities in the field of data visualization are becoming more complex and challenging, and the discipline is growing and becoming more popular. It is through drawing and creating a visual vocabulary that we are able to better explore and communicate data. Creating visuals that encourage close reading and personal engagement will allow people to increasingly find real value in data, imperfect and complex, and what it represents [6].

2.1   Data Stories

The mechanisms of the human brain are stimulated by storytelling. This latter thus helps to assimilate and memorize information faster [7]. Stories have the ability to generate emotions and in doing so, those who receive it carry it with them for a long time; they

do not forget and can transmit it in turn [8]. According to Duarte [9], "If the brain lights up when a story is told, imagine the power of using elements of storytelling to help your audience understand your DataPOV" (= Data point of view). Storytelling techniques seem to be an interesting way to facilitate the understanding of data. Without them, visualizations do not provide explanations about the topic and thus rely too heavily on the audience's ability to interpret the data [10].

In this context, data stories are an important aspect of data visualization because they help to communicate the insights and findings of data analysis in a clear and concise way. They help to make complex data more accessible and understandable to a wider audience and can be used to support decision-making or persuade others to take a certain course of action. While visualizations allow the viewer or reader to explore the data, understand it, and connect information to come to conclusions, Data stories go further: "Data storytelling marries data visualization with a guided narrative. It pairs the data and the graphics with words, not only describing what can be seen in the image, but telling a story to lead you through the analysis process" [11]. To explain the difference between data visualization and Data stories, Stefaner [12] draws a parallel with photography: a data visualization offers a picture of the situation, which allows us to understand aspects of a complex whole, but it does not offer us a single story.

Whether in the academic field or in the media, Data stories are becoming more and more important. The definitions of Data stories are also numerous in the literature. They resonate with each other, sometimes overlapping, and they all emphasize that a narrative is developed and that a story must be told. According to Dykes [13], data storytelling is a "structured approach for communicating data insights using narrative elements and explanatory visuals". A data story is made up of three important elements: data, visuals and narrative. The balance among these three aspects is essential and it is always necessary to start from the data and the insight (the information that emerges).

Furthermore, telling a story with data involves following several steps, according to Nussbaumer Knaflic [8]: understand the context, choose an effective visual, remove cognitive overload, focus attention on something before telling a story. Context here refers to the data available, the audience, and what the audience needs to know or do. Giorgia Lupi and Stephanie Posavec's Dear Data project [14] shows that data, if contextualized, are very powerful tools to explore for writing meaningful and intimate stories. Rodriguez, Nunez and Devezas also bring up this idea of context to refer to the medium used and the way the story is going to be delivered. Indeed, "[storytelling] strategies are very much dependent on the medium and the genre of the story." [10].

Data stories encompass various types of elements that need to be considered when telling a story: the data, the visual form, and the narrative component. The balanced combination of these elements is intended to drive behavioral change through the integration of narrative into the data presentation, and to a call to action or an invitation to change the mindset.

2.2 The Reciprocal Benefit of Data Stories and Data Literacy

Data literacy is the ability to read, understand, create, and communicate data as information and relies on critical thinking and the need to properly access, assess, manipulate, summarize and present data [15]. It is a combination of skills and mindsets that allow

individuals to find insights and meaning in data. Data literacy involves understanding what data means, including the ability to read graphs and charts as well as draw conclusions from data. In today's data-driven world, where data collection, sharing, analysis, and big data are becoming increasingly common, this combination of skills has become increasingly important and essential for effective data communication, decision-making, and problem-solving. It enables individuals to explore, understand, and communicate with data, which is a critical skill in creating data stories. Hence, data literacy is essential for creating effective data stories and could even be seen as its conditione sine qua non. To tell a compelling data story, one must be able to understand and interpret the data, as well as communicate it in a way that is understandable to the intended audience. Data literacy enables individuals to explore, understand, and communicate with data, which is a critical skill in creating data stories.

Data stories, if based on reliable and accurate data sources, in turn, can help to improve data literacy. By presenting data in a narrative format, data stories can help individuals better understand and interpret the data. Data stories can also help make data more accessible and engaging, which can encourage individuals to become more interested in data and to develop their data literacy skills. Data stories and data literacy seem to be closely related concepts. Whereas data literacy refers to the ability to read, write, and communicate data in context, data stories are narratives that transmit conclusions based on findings from data analysis. In summary, data literacy and data stories are connected and intertwined and essential for effective data communication. Data literacy is necessary for creating data stories, while data stories can help to improve data literacy by presenting data in a more engaging and accessible format.

Having in mind that data stories are also characterised by or should lead to a call for action we emphasize here two important competences and their fusion that play an eminent role with respect to data literacy: 1. Empowerment [16] and 2. Acting, or respectively 3. The Empowerment to Act.

2.3 Averroes and His Commentaries

Averroes, also known as Ibn Rushd, was a 12th-century Andalusian philosopher and theologian. He was born in Cordoba, Spain and is best known for his extensive commentaries on the works of Aristotle, which helped to reintroduce Aristotelian thought to the Latin-speaking world [17]. Averroes developed the principle of writing three different commentaires for the same Aristotelian work: short, middle and long commentaries [18]; addressed to different audiences according to their expertise.

His long or literal commentaries were text immanent interpretations of Aristotle's works, focused on explaining the meaning of the words and phrases used. They were written for experts being at the same level of critical thinking. His middle or paraphrasing commentaries rewrote the underlying text, trying to simplify the understanding. These commentaries were more interpretive and aimed to provide a deeper understanding of Aristotle's philosophical concepts making them accessible to a larger public. His short or epitomic commentaries summarized concisely the Aristotelian teaching and condensed them to a maximal degree. These commentaries were meant to provide a basic understanding of the texts for readers who were not familiar with Aristotle's ideas or the philosophical terminology used.

Besides the numerous communication models that have been developed in science since the medieval times, the Averrosian approach impresses through its clarity in differentiation and structuring. It seems promising to consider it as a helpful analogy and heuristic for information and/or data literacy, particularly for data stories that address scientifical, societal and educational issues in the same time.

2.4 Adaptation

Everyone that works with data has had the experience that the number of possible visualizations is almost infinite and can theoretically lead to a large variety of diverse data stories. Similar to the Averrosian approach, the target audience could be used as an instrument to reduce the number of data stories and do some pruning concerning the multitude of possible visual and narrative limitations. This reduction also permits the creation of links between different types of visualizations and the corresponding types of data stories. In addition, it simplifies the creation of appropriate textual elements in which the visualizations are to be embedded.
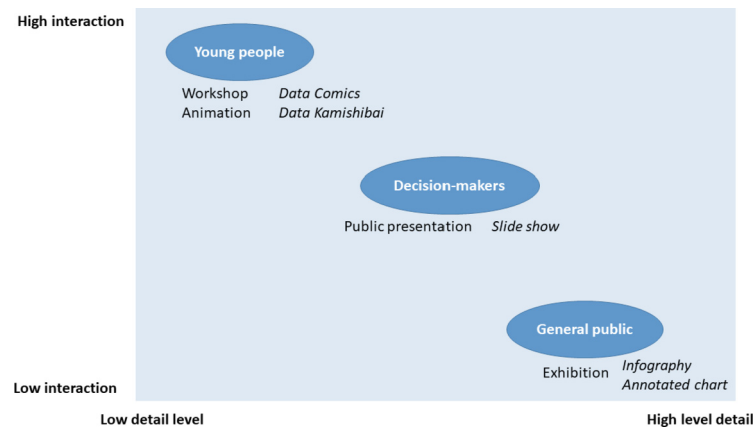
Fig. 1. Types of data stories by audience category, level of interactivity, and level of detail

The concrete type of the data story will depend on the category of the target audience, the level of interactivity possible or desired, and the level of detail of the data story, this latter being itself constrained by the level of interactivity. This assumption lead to a diagram in the form of the 1st quadrant of a right-handed Cartesian coordination system combining all these reflections (see Fig. 1). The most interesting discussion in the research team was held about appropriate data stories for young audiences which shall therefore be explained briefly for the sake of a better understanding: "Data kamishibai" is directly inspired by the kamishibai, "a Japanese narrative genre, a kind of travelling theater where artists tell stories by scrolling illustrations in front of the audience". Data kamishibai would thus integrate to this form of theater some data visualizations well suited to a young audience. The second type of data story that we identify for a young audience is the "Data Comic". It is based on the main elements of a data story and adds

to them the codes of the comic strip. With respect to Fig. 1 it should be noted that the examples given are only indicative and far from being exhaustive. On the contrary, as our approach shows, the appropriate narrative has to be chosen with respect to the data and the audience being addressed.

3 Application

3.1 The Projects VIDAS and MIDAS

The above mentioned concepts, primarily those of data stories and data literacy played an eminent role in two scientific projects done at our institution, namely VIDAS and MIDAS.

VIDAS (Understanding and Explaining Data VIsualization and DAta Stories, 2021–2023) had a rather theoretical orientation and comprised as objectives the charcterisation, definition, and classification of different types of data visualizations, as well as exploring the structure and methodology for developing these visualizations, particularly data sories. A thorough overview is given in Bongi and Sabatini-Choquard [19].

MIDAS (MIcro-Climate DAta Stories, 2021–2023) aimed to design and produce tools for data collection and the mediation of data analysis on climate change for decision-makers and citizens of the Greater Geneva area. This procedure was based on meteorological, climatic and/or environmental data of the corresponding region, also named Lemanic Bassin. From the beginning, the major aim of the project was to engage a large number of external partners and citizens in order to contribute and mitigate findings concerning the impact of climate change and global warming in the said region.

3.2 Data Sets

The quality of data stories and of data literacy do heavily depend on one striking factor, that is the quality of the underlying data. With respect to the limited time frame of both projects it was decided to start with a small and already existing data set to create the first data story, followed by a second attempt with several and more complex data sets, collected, analysed and interpreted by ourselves. For the sake of illustration both data set (collections) will shortly be described in the following sections:

Data Set 1: The Geneva Chest Nut Tree. While looking for ideas of Data stories with a local context being relevant for MIDAS, we came across the history of the Treille (i.e. a location on the border of the old town of Geneva) chestnut tree on the City of Geneva website [20], a very simple and useful data set. Since 1818, the date of the sprouting of the first leaf has been observed and recorded as a marker for the arrival of spring. This theme seemed particularly relevant to us as it is rooted in local history and tangibly illustrates the impact of climate change on our environment. The data stories developed on this theme also seemed to be an appropriate communication tool to raise awareness of the effects of global warming among different target groups (children, adults, decision-makers). The shift in the timing of the emergence of the first leaves of the horse chestnut to earlier and earlier dates could be linked to the warming of Geneva due to climate change. The workflow for the creation of those Data stories is described step by step in a log book published on the project web pages [21].

Data Set 2: Glaciers, Lakes and Rivers in the Lemanic Region. The inital interest focused on the worrying effects of climate change on glaciers and was continously expanded to a broader topic that also includes rivers and lakes in the area called The Greater Geneva (in french: Le Grand Genève): Searching for effects of warming in the waters of Greater Geneva, the data sets comprised data and visualizations of the air temperature in Geneva, the decrease in the volume of the Rhône glacier, the increase in temperature of the Rhône (river), the Arve (river) and Lake Geneva (75% of the water in Lake Geneva comes from the Rhône glacier). The data set was finally completed with data on greenhouse gas emissions in Switzerland.

3.3   Results

The following sections will briefly describe and depict the analysis and interpretations done with the data sets of the two stories.

Triple Data Story Set 1: "Towards an Everlasting Spring Time". Since 1818, the date of the first leaf of the official chestnut tree of Geneva has been recorded as a marker for the first day of spring. The statistical analysis of this record shows a long-term trend towards earlier and earlier dates. This trend is linked to local changes in Geneva, such as the effects of global warming and the urbanisation of the city. Three versions of this story were created in different formats. First, an annotated chart with comments was produced for a scientific audience. Then, two other versions were inferred: a slideshow for decision and policy makers and a Data Comic for young public.

In the context of this article, which is more focused on the methodological approach and the connection between data literacy and data stories, only three basic visualizations will be juxtaposed to illustrate the procedure (see Fig. 2). The complete data stories can be found under https://midas.gexplore.ch/.

All versions of the data stories combine the visualization of the sprouting dates and the number of frost days per year in Geneva, with explanatory text. It seems that a decrease in the number of frost days would be a good indicator of local warming. The corresponding data were provided by MeteoSwiss. The second part of the data stories focuses on the statistical analysis of the sprouting dates, as well as on the future projection of the detected trend and the future impacts on the behavior of the chestnut tree.

Fig. 2. Entry point for the three chestnut tree data stories

We also learned that it is wise to match the data with the expertise of a scientist, in our case a botanist from the Conservatoire et Jardin Botaniques de Genève. The final message of the Data Story was then based on the results of a Master's thesis [22].

Triple Data Story Set 2: "An Ever-Warming Lake, But at What Cost?" The progressive melting of glaciers, the decrease of the water stocks and the temperature increase of rivers and lakes are worrying effects of climate change in the region of Geneva and its surroundings. Starting from an initial version of this Data Story that targeted a scientific audience, we applied graphic design principles to its visualizations to make it more accessible to a general audience [23]. In the third version of the story, the data visualizations were abstracted further, and visualized with LEGO™ bricks, in stop-motion animation in order to make them more appealing and engaging [24] to a younger audience.

Fig. 3. Entry point for the three Lake Geneva data stories

The complete data stories based on this topic can be found on the corresponding website to gather them: https://vidas.gexplore.ch/. Once more only three basic visualizations all visualising the same data chart are juxtaposed (see Fig. 3) for illustrative purposes, reproducing the principle followed in an easy-to-follow way. On the website, a click of any of these icons will lead to the corresponding data story.

4   Conclusions

In the context of two ongoing research projects, we investigated data visualization and its important role in communication. In the context of VIDAS, we wanted to understand what data visualization is and how to make it as effective as possible. With MIDAS, we aimed at designing scientific mediation tools on the theme of global warming in the Greater Geneva area, for different types of audiences. After the first data set was created, internal discussions helped to obtain insights which were then applied to the second data set. It was at that moment that Averroes came to our mind and allowed us to progress. Within the framework of our projects, we identified or imagined different types of data stories, depending on their audience. It should be noted that the creation of a data story requires a significant investment of time but it also requires the contribution of various skills within the team that creates it.

The definitions of data visualizations and data stories are still evolving. However, they hold a central place in scientific communication and they continue to develop. They facilitate communication among research professionals, but also towards citizens. Like any communication object, data stories must be fitted to the audience to which they are intended.

Indeed, all data stories are a way to present data in a narrative format that makes it more accessible which leads to several consequences: Firstly data stories can help

people understand complex data by using a combination of text, images, and interactive visualizations which makes it easier to identify patterns and trends in the data. Secondly, data stories can help people develop their critical thinking skills by encouraging them to question the data and its sources. This can help people become more likely to evaluate it critically. Thirdly, data stories can be used to help people make informed decisions by providing them with a clear and concise representation of the data. This can help people understand and make choices that are based on evidence rather than intuition. Finally, data literacy can foster data literacy across different levels (age and levels of expertise). The data narratives are tailored to different audiences, encouraging fluency.

The case studies show that data stories can be a helpful way to communicate about climate change because they can help to illustrate the impacts and consequences of climate change in a way that is easy for people to understand and relate to. In the future, we will continue this work of exploration and of development of data stories on other subjects and in other forms. We will present them to the different audiences concerned during animations and events and improve them by taking into account the audience's feedback.

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Data Literacy in Public Libraries in Croatia: An Empirical Study

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Abstract. The importance of data literacy in a data-driven world is ever-increasing. There are many definitions for the term data literacy, suggesting different approaches to the topic relevant to many professions, including librarians in public libraries. This paper presents the results of a research study on data literacy in public libraries in Croatia. The results of a questionnaire consisting of 14 closed questions confirmed the increased awareness of the importance of data literacy in 82 Croatian public libraries. The results also showed that librarians in public libraries in Croatia are well acquainted with the knowledge and skills needed to work with data. Their opinions about the role of data literacy in library management and daily library operations were also positive. However, not a single library in the research study employed a data librarian, an expert whose job would be to plan and implement new services based on data management.

Keywords: Data literacy · public libraries · Croatia

1 Introduction

As the digital transformation of society continues, so does the demand for employees with an increasing number of new types of knowledge, skills, and competencies. One new, interesting, and very popular area of knowledge is data literacy. As the importance of data and its amount increases in many areas of life, and data has become the new 'currency' of power [1], data literacy has become critical in education and careers worldwide. Twenty-first-century citizens are expected to be able to use twenty-first-century skills, including data literacy, to succeed in the knowledge economy [2]. To achieve this goal, individuals, businesses, and information institutions must have the knowledge and competencies related to the latest developments in information communication technologies (ICT) and society. Libraries are one such information institution that is constantly changing and developing, and librarians, as its most valuable resource, have acquired additional knowledge and competencies to remain relevant in the challenging information environment of the third decade of the 21st century. The importance of libraries is undeniable: they are the intermediary between different categories of users and human knowledge and "the service institutions, knowledge hubs that form the backbone of a society, provide information access, and promote its cultural well-being" [3, p. 764]. Consequently, this paper focuses on data literacy in public libraries in Croatia, which is an important prerequisite for providing excellent services to users and society.

2 Data Literacy

Numerous definitions of data literacy have been published and analyzed from different perspectives. In general, data literacy is "a specific skill and knowledge base that enables individuals to transform data into information and actionable knowledge by enabling them to access, interpret, critically evaluate, manage, and ethically use data". (this definition will be used as a reference point for the research study in this paper) [4, p. 10]. A comprehensive review of the importance and role of data literacy today by Ridsdale et al. [2, p. 46] stated, "Data literacy is the ability to collect, manage, evaluate, and critically apply data". The same authors [2, p. 46] added that "data literacy is seen as a critical aspect of and foundation for the skills (e.g., computational thinking) required to function in the business, academic, social, and political contexts of the 21st century." Digitally literate individuals "must be able to effectively access, handle, and use data" [5, p.125] or they should be "able to access, analyze, use, interpret, manipulate, and reason with data sets to address the ubiquity of (digital) data in various domains" [6]. Petras et al. [7] understood data literacy as the ability to use digital data in a critical and solution-oriented way, dealing with digital data throughout its lifecycle, and using infrastructures for its processing, analysis, and delivery, including publication, to its long-term protection and after-use. The DQ Institute sees digital literacy as part of the digital intelligence needed to live in today's world. It proposed eight areas of digital intelligence:

- digital identity,
- digital use,
- digital security,
- digital emotional intelligence,
- digital communication,
- digital literacy, and
- digital rights [8].

Data literacy has become accepted as the ability to transform information into actionable instructional knowledge and practices through collecting, analyzing, and interpreting all types of data [9]. People need digital literacy to participate in and benefit from digital opportunities in the community and to mitigate risks and threats in the everyday digital environment related to device protection, personal data and privacy, and health and well-being [10]. The concept of data literacy is also found in the teaching environment. Data literacy is one of the necessary skills and important qualities for students entering society in the Big Data era [11]. With time, data literacy will become an important civic skill that should be present in every society in the 21st century [12].

3 Research Study

3.1 Method and Sample

Public libraries in Croatia have been continuously introducing changes - new technologies, new types of library materials, and new services - and librarians are acquiring new knowledge, skills, and competencies necessary to remain relevant to their users and their

founders now and in the years to come. Data literacy is one such knowledge area that has become popular in libraries. The popularity of data literacy can be attributed to the overall popularity of data analytics for business management and managerial decision making and other operational purposes already present in public libraries. To find out more about the current state of data literacy in public libraries in Croatia, a research study was conducted.

The study aimed to collect data from public libraries (usually from the library managers) about the main facts related to data literacy in public libraries and the perception of public libraries regarding the use of data literacy for library operations and activities. The study's main hypothesis was that public libraries in Croatia have a high level of awareness of the importance and knowledge of the practical application of data literacy, which is necessary for library management and daily work. A questionnaire with fourteen closed questions was selected as the main research tool to obtain responses from geographically dispersed participants employed in public libraries. The options in questions were derived from the literature (see References) and from the resources of the government of the Republic of Croatia (for areas of science librarians received training in) and some options were originally made for this research study. The research was initiated on February 14, 2023 and was completed on March 15, 2023. Invitations to participate in the study were sent via e-mail to a total of 188 e-mail addresses of public libraries in Croatia. The e-mail addresses were obtained from the official national register of public libraries available at the National and University Library in Zagreb, Croatia. Forty-six invitations were returned as undeliverable, resulting in the successful delivery of invitations to a total of 142 public libraries in Croatia. A total of 82 public libraries (58% of the delivered invitations and 44% of the total number of registered public libraries in Croatia) responded to the invitation and participated in this research study according to Google Forms. Since some libraries did not answer all questions, the number of total answers given varies from question to question from 78 to 82.

4   Findings

This part of the paper presents the results of the research study on digital literacy in public libraries in Croatia.

Library managers in Croatia are all trained librarians as required by the national Law on Libraries and Library Services. In the introductory part of the questionnaire, library representatives/library managers in public libraries in Croatia (they are all trained librarians as required by the national Law on Libraries and Library Services) were asked about the scientific fields in which they were trained as this affects their knowledge of working with data. Thirty-nine point six% (N = 32) of the librarians (out of a total of 81) had a combined education in social sciences and humanities. Fewer had education in social sciences only: 28.4% (N = 23). And 22.2% (N = 18) had education in humanities only. A small number were educated in other areas of science (three librarians or 3.7%), two librarians (2.5%) had educational backgrounds in the natural sciences, and an additional two librarians (2.5%) had studied political science. None of the respondents had an education in a technical field or medical sciences. Cumulatively, about 90.0% of the respondents had a degree in social sciences or humanities or a combination of both.

The next question aimed to determine in which areas librarians have acquired knowledge related to data literacy during their university education. The results in Table 1 show that mathematics and data visualization were poorly represented in the responses, while knowledge of ICT, in general, was the most frequently mentioned. Mathematics courses are not frequently offered, but they are offered in statistics (yet, only 39.2% of librarians in this study confirmed knowledge of statistics), both of which are required for working with data. The correlation between the number of studies taken at the university (social sciences and humanities are two separate studies for which students at the end of the study receive two diplomas) and the number of different areas of knowledge r = 0.08, which is a very weak positive correlation.

Table 1. Discovering areas of knowledge related to data literacy (N = 81)

	N	%
Information and communication technology	65	80.2
Library science	65	80.2
Knowledge management	41	50.6
Statistics	32	39.5
Database management	22	27.2
Logic	14	17.3
Math	9	11.1
Visualization of data	9	11.1

The next part of the questionnaire offered questions about the use of data in public libraries. Data in libraries are used for different purposes. One such purpose is making management decisions based on data collected and processed on library premises. Recent years provided a plethora of data by computers and various types of sensors and were collected from library users when using library services. Seventy point seven % of public libraries participating in this research study used data to make management decisions. In Croatia, public libraries have a legal obligation through the Law on Libraries and Library Services to collect different types of data and upload them to the portal of library statistics in the National and University Library in Zagreb, Croatia at http://mat icna.nsk.hr/statistika/. This includes general data about the library, services, and their use, holdings, access and equipment, library budget, and library staff. The data provide a general insight into the operational parameters of public libraries on an annual basis.

This question was aimed at identifying data-related competencies important for library management. All answers (Table 2) showed that librarians recognized the value and importance of data in library management in general. When we compare the results in Table 4 with the results of this question, we can see certain similarities in the pattern of selection of answers regarding the valuation and ethical use of data. Both responses were ranked higher in this question than in question 4 while interpreting data is ranked lower in this question than in question 4. Although the responses describe the same activities and competencies, they are ranked differently for respondents.

Table 2. Data-related competencies important for library management (N = 81) (multiple answers were possible)

	N	%
Organizing and storing facts	69	85.2
Evaluating data used in a business environment	69	85.2
Ethical use of data and safe use of data	64	79.0
Understanding data used in a business environment	63	77.8
Decision making based on data	63	77.8
Interpreting data	60	74.1
Communicating and presenting using data	59	72.8

The next question aimed to identify public library activities related to data literacy as recognized by the librarians participating in this research study. The respondents were asked to select any from a total of eleven possible responses (Table 3). The top three responses were generally closest to the daily practices in public libraries. Since 70.7% (N = 58) of the public libraries in this research study recognized the use of data for making management decisions, it is possible to conclude that librarians in public libraries are familiar with several data related activities relevant to the public libraries in Croatia.

Table 3. Activities related to data literacy (N = 81) (multiple answers could be chosen)

	N	%
Data collecting	68	84.0
Data evaluating	68	84.0
Data management	65	80.2
Data interpreting	63	77.8
Data application/use	58	71.6
Data access	56	69.1
Ethical use of data	56	69.1
Data finding	53	65.4
Data filtering	51	63.0
Data manipulation/handling	45	55.6
Communicating data in the context	39	48.1

In addition to acknowledging use of data and data literacy-related activities, this question aimed to identify whether librarians in the public libraries acknowledged the data lifecycle (Table 4). The librarians relied on metadata to describe library collections and their work on data is important to the future of libraries. At this point, librarians were

ahead of some other professions that were exposed to big data for the first time as they had been working with data for decades. The other responses given by the librarians in this study, except for the last two, also fell within the realm of the work of librarians, so the librarians recognized their importance.

Table 4. Data life cycle used in daily library practices (N = 81) (multiple answers were possible)

	N	%
Collecting and describing data	73	90.1
Data storing	66	81.5
Archiving and keeping data	60	74.1
Data creating	59	72.8
Providing access to data	55	67.9
Reuse of stored data	37	45.7
Discovering data and their analysis	34	42.0

After the questions focused on the use of data and data-related activities, the public librarians were asked about the employment of a data librarian. Not a single public library (N = 80) employed a data librarian.

The next question identified activities such a person should perform. The responses to this question (Table 5) indicate that the librarians considered interacting with researchers, and promoting data management services to be the most important activities. The librarians also thought a data librarian might engage in three other activities related to the development and planning of library services. The perception of data as a foundation for library development is important because libraries cannot afford to become obsolete in a society that is moving faster and faster toward data-related services.

Data librarians need adequate skills to be able to perform data-related activities. These could include different skills, here shortlisted from the available relevant literature (Table 6). One should keep in mind that a data analyst should have a solid knowledge of mathematics and statistics. Other responses, such as critical thinking, metadata creation and management, problem solving, and research support, are intrinsic to the librarians' profession. For librarians who do not possess the enumerated skills, there is an opportunity to gain them in some continuing education programs offered to librarians by the National and University Libraries in Zagreb, Croatia and there are also short courses on topics related to data, artificial intelligence, machine learning, and deep learning provided by different commercial firms. (Table 8).

The responsibilities and activities of a data librarian were not the only ones performed in public libraries in Croatia. Table 8 presents answers to the question about the opportunity to connect the concept of data literacy to existing jobs in their public library. The first two responses (Table 7) indicated librarians' interest in using data to work with users, analyzing their library use, and their satisfaction with library services, both of which benefited greatly from the analysis of collected data. The next two responses, library management and acquisition of library materials, also relied on data collected

Table 5. Activities a data librarian could participate in (N = 82) (multiple answers were possible)

	N	%
Interaction with library users doing research and promotion of services for data management	62	75.6
Development of services/infrastructure for data management	59	72.0
Development of library services related to data management, archiving, and dissemination	54	65.9
Development of policies, procedures, and guidelines necessary for planning services for data management	52	63.4
Counseling library users researching how to manage, archive and disseminate research data	49	59.8
Training of library users seeking data-related services	40	48.8
Counseling library users about legal issues related to data	30	36.6
None of the above	3	3.7

Table 6. Skills data librarians should possess (N = 81) (multiple answers were possible)

	N	%
Analysis of quantitative and qualitative data	67	82.7
Critical thinking	60	74.1
Working with statistical software	57	70.4
Creating and managing metadata	55	67.9
Problem solving	50	61.7
Data visualization	49	60.5
Research support	44	54.3

about the use of various services in libraries. In question number 2, the respondents indicated that 70.7% of them used data for library management, and this question also scored highly on the same response.

In 2023, there are still no courses at the university level dealing specifically on data literacy. There are courses in data science, big data, and quality of data, but not for students of librarianship. Therefore, students lack knowledge about dealing with data before they find employment in libraries. Table 8 shows the most frequent choices of the respondents about the acquisition of knowledge about data literacy after graduation.

The last three questions in the research study were oriented toward estimations about the importance of data literacy for daily activities in the public libraries in Croatia, library management, and library development. In all three categories, the respondents provided answers suggesting the high importance of data literacy in libraries; these data available upon request to author. The respondents indicated that library management and library

Table 7. Data literacy and jobs in public libraries (N = 78) (1-not applicable at all; 5-highly app.)

	1	2	3	4	5
Work with user analysis	2	1	8	22	48
User satisfaction with library services	1	1	10	18	47
Library management	2	0	8	23	45
Library materials acquisition	2	1	13	22	39
WebPAC	2	2	18	17	38
Administrative jobs in the library	2	4	19	18	35
Library collection development	3	2	12	29	33
Recommendations of library material based on computer data	3	1	20	17	33
Self-check-in and check-out of books	4	21	21	13	16

Table 8. Ways of education in data literacy (N = 82) (multiple answers were possible)

	N	%
Courses in the Center for permanent education at the National and university library, Zagreb Croatia	63	76.8
During education at university at the Ph.D. level	57	69.5
Webinars on the internet	54	65.9
Courses in libraries organized by someone else	48	58.5
Self-education by reading literature on the topic	46	56.1
Courses at university (graduate level)	34	41.5
IFLA internet resources	27	32.9
Practical knowledge of working with data	1	1.2

development could benefit more from the application of data literacy than daily activities in libraries.

5   Discussion

Data literacy plays an important role in many aspects of our lives where we encounter different types of data. So does data literacy in the daily practice of public librarians in Croatia. To be able to use data in daily library operations and activities, a librarian must possess different types of knowledge and skills and keep expanding them continuously. Some of this knowledge and these skills are available as part of the information sciences study programs at different Croatian universities while others are available as free and paid courses outside of academia. This research study discovered that most librarians were educated in social sciences, specifically education in information and

communication sciences. This discipline, the official title in Croatia is that of information and communication science, included the study of topics like information literacy and its subtypes, machine learning, artificial intelligence, programming languages, and database management, but not a separate course in data science. When speaking about librarians' views on knowledge related to data literacy, traditional knowledge areas were still prevalent, probably because of the formal education/training of librarians. A great number of the public librarians in Croatia participating in this research used data for management purposes, which is encouraging. This is a continuation of similar practice since the introduction of personal computers in libraries, but this time the number of librarians using data for management is significantly greater. As a result of such practice, the librarians in this study recognized important activities related to data precisely and ranked them as important for the future of libraries. Similarly, while the librarians participating in this research recognized parts of the data life cycle they encountered in daily library practice, their use tended to be on the traditional side of library activities in that they related to jobs or positions in public libraries. The librarians recognized all competencies important for library management and ranked them almost equally. Not a single library employed a data librarian at the time of carrying out this research study but they provided information about activities such a person would do in libraries. These activities were focused mostly on users and library services and required knowledge and competencies like data analysis, critical thinking, the use of statistics, and creating metadata to perform jobs like library management, and providing services to users. All of these activities were well known in all types of libraries, however, in a more traditional form, without the application of big data. The librarians in public libraries in Croatia sought additional knowledge after they have concluded their formal education at universities in Croatia or elsewhere, mostly in programs of continuing education, Ph.D. studies, and internet webinars. Finally, the participants confirmed the importance of data for the successful completion of daily activities in public libraries and for library management and library development.

6 Conclusion

Public libraries are knowledge hubs for local communities and society in general, and they are changing almost simultaneously with society as it transforms into its digital counterpart. Digital transformation includes the use of vast amounts of data and requires knowledgeable and competent individuals who will be able to deal with data in different contexts and different institutions. The digital transformation also depends on the availability of the financial and other means, so, public libraries in Croatia are following the suggestions for development and digital transformation of their founding bodies (cities in which libraries exist and the Ministry of culture and media of the Republic of Croatia). The results of this and similar studies that will follow in the future could serve as guidelines for implementation and more data intensive services in public libraries and employment of data librarians. Public librarians in Croatia and their views on data and data literacy were the focus of this paper and research study. The results of the research showed that the librarians were aware of the most important characteristics of data literacy. Librarians were well acquainted with the data lifecycle and used data in

library management and other activities performed in libraries. These are good starting points not only for future research studies but also for practical changes and interventions in daily practices of public libraries in Croatia. One such point was that the librarians sought additional knowledge about digital literacy actively and mostly in the form of short courses, courses on the Ph.D. level, and internet Webinars. While they felt a lack of knowledge on the topic of digital literacy they already made an important step to increase the level of knowledge about data literacy. The research study also revealed that public libraries in Croatia did not employ a single data librarian, although they understood what jobs such a person would do. The next step would be for public librarians to ask their founders for such an employee and to corroborate this request by providing the results of this and similar research studies. Moreover, public librarians were already using data in library management and this was also an evidence that data librarian is necessary. Finally, the views of public librarians in Croatia on the role of the use of data and data literacy in library management and daily operations in libraries were also positive. That would help them in expanding the use of data in development and providing their services to the public. It remains to be seen if public librarians will be successful in planning, creating, and executing new library services based on new data-intensive technologies. Their education at the university level is improving by introduction of new data and data literacy courses into study programs and now the government (i.e., the Ministry) should also react and facilitate further development of public librarians in Croatia. Both librarians and users will certainly benefit from data based library services to improve not only use of material and services in public libraries in Croatia but also to improve their daily activities by using new technologies like deep learning and artificial intelligence which are already part of our lives.

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Who are Physicians Talking to on Social Media? Needed Data Literacy and Visual Literacy of the Assumed Audience(s) of COVID-19 Vaccination Posts

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Abstract. The manuscript focuses on the partial results of a project on the effectiveness of social media posts by medical experts to encourage people to be vaccinated against COVID-19. It demonstrates how the authors of the posts used scientific data, visualizations thereof, and sources of information. 220 posts from 49 profiles of doctors selected purposively qualified for the study and were examined using a content analysis technique. The article explores the results obtained for the selected categories. 54% of the analyzed posts did not present data at all. The rest cited the vaccine efficacy data the most frequently. Foreign scientific research and the Polish government or public agencies dominated data sources. The most frequently linked profiles were these of other experts and the visual elements such as photos and infographics. The results are discussed from the perspective of the data literacy and visual literacy (as dimensions of digital literacy) of the assumed audiences.

Keywords: Digital literacy · Data literacy · Visual literacy · Vaccine hesitancy · Content analysis

1 Introduction

As we faced one of the most significant public health challenges of our time, the COVID-19 pandemic underscored the critical role of effective communication in managing the crisis. The development and distribution of vaccines was hailed as pivotal in controlling the spread of the virus and, as such, promoting their uptake has become a significant public health initiative. Given their credibility and the trust that the public places in them, physicians are well-positioned to advocate for vaccination. Nowadays, doctors and scientists are not only present in their natural hospital or laboratory environment but also on social media, which serves as a significant avenue for information dissemination and persuasion on important social and political issues.

The power of social media lies in its ability to reach vast audiences, disseminate information rapidly, and create spaces for dialogue, to some extent. In the context of COVID-19, these platforms were instrumental in circulating updates on the pandemic, prevention strategies, and vaccination progress. At the same time, sharing content on these

platforms faced some challenges, among which the misinformation and disinformation spread appeared the most crucial [1].

Therefore, our study aimed to analyze how Polish physicians used social media to encourage COVID-19 vaccination. In this manuscript we focus on specific elements of the social media posts published by the doctors, namely the sources of information and data visualizations they employed. Furthermore, we seek to interpret these practices through the lens of data literacy and visual literacy. These two crucial competencies enable individuals to understand, interpret, and make informed decisions based on the information presented to them in the context of the material analyzed.

2 Theoretical Framework

2.1 Social Media and Vaccine Hesitancy

As a space for public debate and for persuading (or discouraging) users to engage in pro-social behaviour, social media is becoming an increasingly important research field. This is due to their nature and functionality and their growing popularity. In 2021, -the year from which the data presented in this article is taken, Poles spent an average of 1 h 49 min per day on social media, while they spent an average of 6 h 39 min on the Internet in general [2]. Social media platforms were used by 83.00% of Poles over the age of 13. Facebook remained the most popular with 17.65 million users in Poland [2]. Among the many different functions, searching for health information on the Internet (including social media) was gaining importance. It was particularly relevant in the context of pandemics and immunisation. As it turned out, social media was a space where vaccine misinformation was robust, popular, and engaging [3]. Research has proven that exposure to misinformation lowers the intention to vaccinate to protect oneself and the altruistic intention to vaccinate to protect others [4]. Moreover, misinformation of a supposedly scientific nature (e.g., emphasising a direct link between the COVID-19 vaccine and adverse reactions while using scientific images or links to reinforce their claims) has been shown to be particularly detrimental to vaccination intention [4].

Infodemic about COVID-19 spread rapidly on social media [5]. This was particularly dangerous in the context of knowledge about the links between social media use and vaccine hesitancy [3, 6–10]. As established in a cross-sectional study including respondents from 27 European Union countries, there was a significant association between social media usage and the likelihood of vaccination [11]. Specifically, it showed the profound influence of social media as the primary information source on vaccine hesitancy. It also revealed that individuals or groups with higher levels of vaccine hesitancy demonstrated a greater dependence on social media platforms for obtaining news and information [11].

Moreover, the very structure of social media makes it impossible to assume that this can be effectively counteracted. Research has shown that content transfer occurred predominantly among users with similar views on vaccination, while it rarely happened among those with differing opinions. It indicated that the design of such platforms may create the impression of debate but, in reality it primarily reinforced existing beliefs rather than promoting the exploration of new perspectives [12].

Meanwhile, good quality personal contact with a doctor and trust in experts generally had a colossal impact on the decision to vaccinate, including against COVID-19 [13]. Trust in scientists,- alongside higher performance on numeracy tasks, - was associated with lower susceptibility to misinformation in the context of COVID-19 [14].

2.2 Data Literacy and Visual Literacy

Now that we know the importance of social media in influencing people's opinion and action on immunization in a pandemic, and especially the sources and type of information posted there, it is essential to define the critical terms for further analysis: data literacy and visual literacy. Data and visual literacy can be treated as dimensions of digital literacy, "the ability to understand and use information in multiple formats from a wide variety of sources when presented via computers" [15, p.1]. Both concepts also have quite precise definitions that draw attention to the specific functions of both types of competence.

Data literacy is defined as "a suite of data acquisition-, evaluation-, handling-, analysis- and interpretation-related competencies" [16, p.124]. These skills act as the mechanism that empowers individuals to "access, interpret, critically assess, manage, handle, and ethically use data" [16, p.126]. Calzada Prado and Marzal set the concept of data literacy in a broader context and in relation to another key concept: information literacy. They point out that data literacy can be understood as the "component" of information literacy, encompassing the skills necessary for individuals to access, interpret, critically evaluate, manage, manipulate, and ethically utilize data. From this viewpoint, information and data literacy are interconnected and exist on a continuum, representing a gradual journey of scientific and investigative education throughout the users' lives [16]. This perspective is also helpful in this article. Among the five components of data literacy, two seem crucial in the context of this article: (1) understanding data and (2) reading, interpreting, and evaluating data [16].

It can be stated that data literacy is crucial when it comes to evaluating and understanding information on health issues across different forms of media. "Data literacy implies critical thinking, and the skills involved are crucial to becoming responsible, involved, and contributing members of society" [17, p.23]. For Carlson et al. [18, p.633], data literacy entails "understanding what data mean, including how to read graphs and charts appropriately, draw correct conclusions from data, and recognize when data are being used in misleading or inappropriate ways". Data literacy became increasingly important in our data-driven society, especially in a professional context [19].

As for the concept of visual literacy, it is broad and has evolved over the years [20]. In its broadest sense, "visual literacy is the ability to read and understand images" [21, p.8]. Another definition emphasises that it is "a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media" [22]. Furthermore, it is worth noting that visual literacy as a competency can be divided into two types: functional and nuanced. "Functional visual literacy can be said to operate primarily at the iconic and indexical levels, and the 'reader' engages mainly on a denotative level of meaning. Nuanced reflective visual literacy requires of the 'reader' to engage on a connotative level (analogical, symbolic and mythic) " [23, p.85].

Data literacy plays a role in understanding health information and making informed decisions about vaccination. With the proliferation of health data, including scientific studies, public health reports, and health news, being able to interpret and understand this information is more important than ever. Also visual literacy is becoming a critical skill in the health sector, particularly when making informed decisions about vaccination. With an overflow of health information presented visually, understanding and interpreting these visuals accurately can impact health behaviors and decision-making [24].

3   Methods

The manuscript focuses on the partial results of a project on the effectiveness of social media posts by medical experts to encourage people to get vaccinated against COVID-19. We conducted the study with support from the "New Ideas" grant, no. 622–62/2021, financed by the University of Warsaw. The project involved the triangulation of research methods and was implemented in three stages:

1. Mapping experts (physicians) active in SM and aggregating their posts on vaccinations.
2. Analysis and typology of posts in terms of content and form.
3. Experiments (using surveys, eye tracking and face tracking measurements). In this article I will focus on the partial results of stage 2.

The sample selection was purposive. After mapping the most active Polish physicians in social media, we chose the posts they published, containing the key term "vaccination" or "vaccine" used in the context of COVID-19. We aggregated the posts published on Facebook, Instagram, and Twitter in 2021, specifically in January, March, May, July, and September 2021. These were during times of significant pandemic-related events (e.g., the rollout of COVID-19 vaccines in Poland and the global news regarding thromboembolic incidents associated with one of the vaccines). Two hundred and twenty posts from 49 profiles of medical doctors qualified for the study. We examined the posts using a content analysis technique with narrative and rhetorical analysis elements using a codebook with 53 categories. Two coders coded each unit of analysis (post). We will explore the results obtained for the following categories: *topics of the data cited, sources of the data cited, profiles linked,* and *visuals included in the posts (photos, infographics, videos, memes, and others).*

It should be noted that we did not test the level of required data literacy and visual literacy of the audience in the project. However, based on the evaluation of the posts' content (the categories mentioned), it is possible to infer to some extent what the required level of these competencies would be expected to understand the content of the posts. This provides a starting point for understanding how the doctors asthe creators of the studied posts envisioned their audience in terms of the mentioned literacies.

4   Findings

We will start by presenting the data cited in the surveyed posts. First, it should be noted that as many as 119 of the surveyed posts (54%) did not present data at all. This result may be surprising given that the authors of the surveyed posts were doctors. In convincing people to vaccinate against COVID, they either adopted strategies other than the rational one (by referring to facts and data precisely) or used the rational one but weakened it by not using data as a premise for the thesis. The remaining posts contained data on one or more thematic topics (Fig. 1).
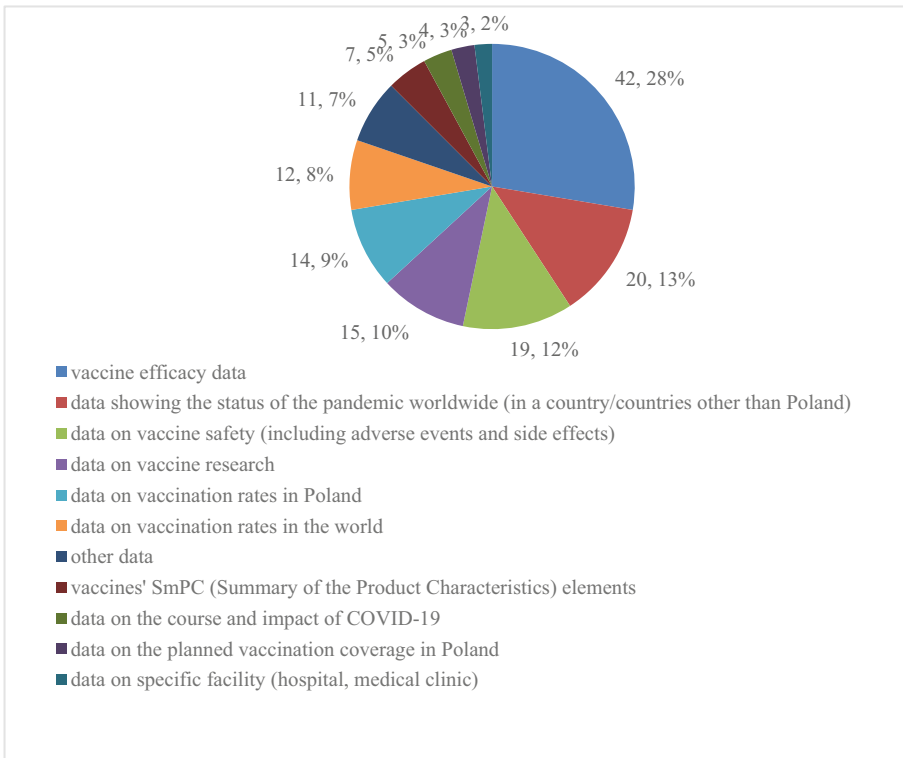

Fig. 1. Topics of the data cited

The data provided offered valuable insight into the substantive types of data physicians most frequently cited when encouraging COVID-19 vaccination on social media. Most prominently, vaccine efficacy data appeared forty two times, suggesting that doctors were keen to emphasize the effectiveness of the vaccines to their audience.

Data showing the status of the pandemic worldwide was the third most frequently cited, appearing twenty times. This suggested that physicians were providing global context and comparative understanding, emphasizing the international nature of the crisis and global response efforts. Data on vaccine safety, including adverse events and side effects, and vaccine research data, were also frequently cited, appearing nineteen and fifteen times respectively. These points of reference helped to address safety concerns and showcased the robust scientific process behind vaccine development.

Data on vaccination rates, both in Poland and worldwide, were featured in fourteen and twelve posts respectively. By sharing this information, physicians informed the public about the progress of the vaccination campaign and the collective effort to achieve herd immunity. Data on the course and impact of COVID-19 were infrequently cited, appearing only five times. That was a natural consequence of the material selection criteria focused on the vaccines themselves. However, it might also suggest that the course of the pandemic was not the strongest or the most popular argument for encouraging vaccination.

The SmPC provides detailed information about the characteristics, usage, dosage, and contraindications of vaccines. Physicians referred to elements of the SmPC seven times), wanting to share specific details from this document to inform their audience. The data related to the progression and impact of COVID-19, including disease severity, long-term effects, and implications for public health, appeared in five posts. Other types of data, appearing eleven times, included very specific data (such as vaccination rate in the zoo or COVID-19 fatality rate among children in Florida) and was related to the specific topics presented in the posts.

It can therefore be concluded that doctors were divided in their assumptions on the data literacy of their audiences. In almost half of the posts examined they did not use the data at all, so they either assumed that it would not be convincing or gave up on it as too tedious. The other group, by presenting and referencing different data points, expected their audience to understand and interpret the information provided. The emphasis on vaccine efficacy data indicated that physicians expected their audience to grasp the concept of efficacy and its significance in determining the effectiveness of vaccines. The inclusion of global pandemic status data suggested that physicians probably believed their audience could comprehend and contextualize the international situation surrounding COVID-19. Furthermore, the references to vaccine safety and research data implied that physicians anticipated their audience to have the ability to evaluate and understand scientific information related to vaccine safety and the research process.

The next thread we analysed revealed the types of sources that physicians cited in their social media posts aimed at encouraging vaccination against COVID-19 (Fig. 2).

Fig. 2. Sources of the data cited

Notably, there was a predominance of foreign scientific research, with it being referenced twenty eight times in the sampled posts. This suggested a reliance on global research efforts in discussions about the vaccine's safety and efficacy, highlighting the trust physicians placed in international scientific literature and their willingness to expose it.

The second most cited source was government or public agencies such as the Ministry of Health or the Chief Sanitary Inspectorate. It was natural since these institutions (which, by definition, can be considered reliable) had aggregate data in the pandemic that depicted the vaccination process.

The other sources of information appeared less frequently, including Polish experts, international organizations, Polish media, foreign media, and foreign public institutions or agencies, each referenced seven, six, six, five, and five times, respectively. These sources broadened the scope of information to some extent, but also showed the thematic and source dispersion of the posts examined.

However, what was also noteworthy was that, in twenty two cases (21% of the posts presenting data), no specific source of information was cited. This fact should be considered an oversight by the authors, which may reduce the credibility of the content presented.

We will now present the profiles linked in the posts analysed (Fig. 3).

- experts
- public institutions
- scientific or medical associations
- news media
- hospitals
- other
- official profile of governmental provaccination campaign

4, 10%
4, 10%
4, 9%
5, 12%
5, 12%
9, 21%
11, 26%
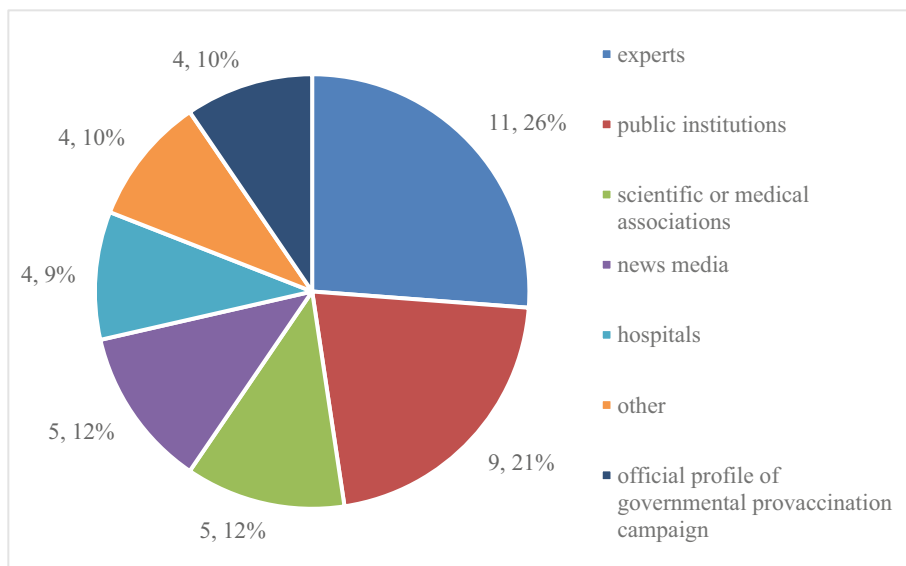
Fig. 3. Profiles linked in the posts

The most frequently linked profiles were these of other experts (physicians, researchers) with eleven mentions, suggesting that the authors were leveraging the insights and credibility of experts in their communication about the importance of COVID vaccinations.

Following this, public institutions were the second most commonly referenced, with nine mentions, which was understandable as these institutions shared official data during the pandemic. Scientific or medical associations and news media came next with five mentions each. These entities were exposed in the context of vaccine advocacy and were a source of official recommendations, while news media were cited as providing information on current events. Hospitals, other sources, and the official profiles of governmental pro-vaccination campaigns had four mentions each, signifying their roles as credible sources of information for the posts' authors.

Both the citation of data sources and the linking of profiles (which also in part serve as data sources), to some extent, appeal to the data literacy (and even information literacy) of the audience. Behind these citations is the assumption that the cited sources and profiles were, firstly recognisable and, secondly, credible to the followers. Furthermore, this aws quite natural with institutions such as the Ministry of Health or the Chief Sanitary Inspectorate. However, the issue became problematic with foreign institutions such as the US FDA or a foreign scientific journal. In that case, knowledge of these entities (and the acronyms of their names) or the ability to find information about them already required a higher level of information literacy.

The last topic presented is the types of visual material presented in the posts (Fig. 4). We will start with a panoramic view of all the visual materials used and then discuss

the type most appropriate for presenting data, namely infographics. First, it is worth underlining that forty seven posts did not include any visual material. These were mainly Twitter posts, which are much less likely to feature a photo than content on other social media platforms.
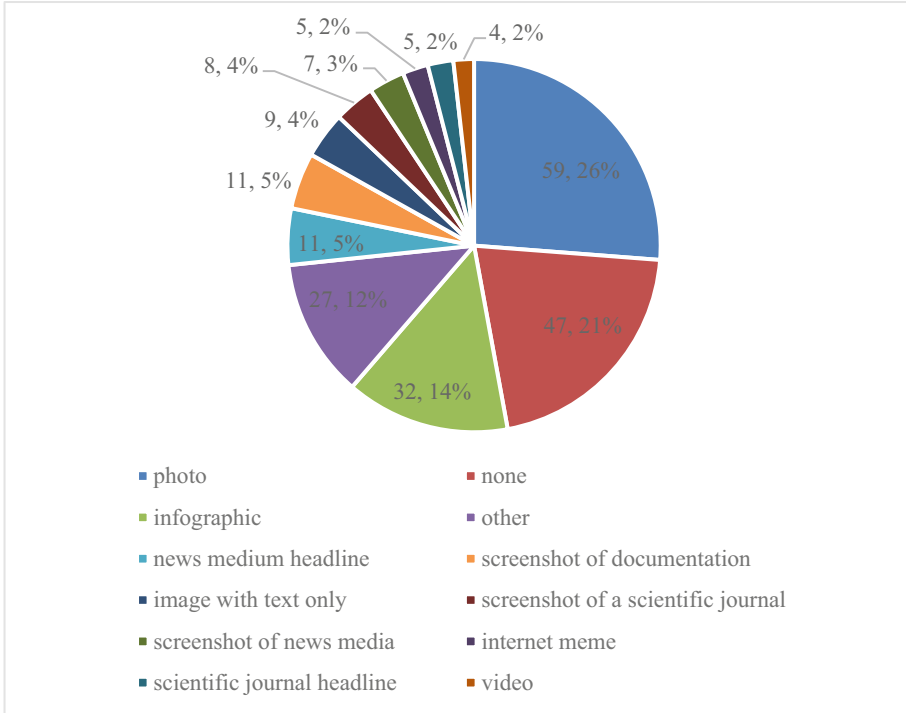
Fig. 4. Types of visual materials presented in the posts

Most noticeably, photos were the most commonly used visual element, appearing in fifty nine instances. This resulted from the fact that physicians utilized personal images, both in private and public situations, which served to create a sense of authenticity and to humanize their messages.

Other visual material types includied screenshots of scientific journals, news media, or documentation, as well as news medium headlines, occurred less frequently, but still played an important role. They had been used to directly reference and authenticate the information being shared.

Interestingly, internet memes were relatively rare in this context, derived from the posts' content. The intertextual references that memes provided made the content more attractive and engaging, but they can also turned off audiences who needed help decoding the meanings contained within.

The category 'other', comprised twenty seven instances, contained mainly screenshots from other authors' posts and extracts from official documentation or scientific publications. There were also a few collages and cartoon graphics.

Last but not least, infographics were the second most commonly used type of visual material, appearing in thirty two instances. These can effectively communicate complex data or concepts in a simplified and visually appealing manner, increasing understanding and retention of the information. Indeed, some infographics made the content more attractive in the cases analysed and illustrated the scientific data interestingly and understandably. However, some of the infographics caused some challenges in reception. First, some of these materials (from foreign sources) were published in English and only partially explained in the post's content. It could result in a lower understanding of the message among non-English-speaking audiences. In some of the infographics, there were graphic modifications by doctors, s such as notes, comments, and highlights, which on the one hand, drew attention to the essential elements of the image, but on the other hand, reduced its readability. Therefore we assumed that doctors understood the importance of visuals explaining scientific data for the persuasiveness of posts, but at the same time, did not use them very skillfully. Consequently, a higher level of audience visual literacy was needed to decode such content.

5   Discussion

Summarising the results presented, the question to be answered is whether data literacy and visual literacy were required in analysing posts and, to what level.. Although it was difficult to generalise, some specific conclusions could be drawn. The analysed material was highly heterogeneous. Some of the doctors' postings did not present any data at all, while some of those containing data did not mention their source. Among the analysed postings, some materials were even expert and required expert knowledge to interpret the data they contained. Some intuitively exposed simple data leading to an unambiguous conclusion, usually that vaccines were safe and it was worth getting vaccinated. Certainly, however, the authors of the surveyed posts needed to use the potential offered by the graphical representation of data, especially in the form of infographics. Only a few posts used infographics, and some of these (if only through medical jargon or English-language content) may have been counterproductive, especially as we know that even digital natives are not particularly adept at producing and interpreting visual communication [25].

Overall, it can be concluded that at least some doctors were communicating (in the context of the data presented) with an audience that was highly competent in data literacy and visual literacy.

Certainly, however, reflection on the analysed material can lead to the well-known conclusion about the need to educate internet users in data and visual literacy [26]. This need becomes acute, especially during events such as a global pandemic and the need to quickly convince a large audience of the validity of receiving immunisations. The battle for the attention and conviction of internet users in such situations is fought primarily on social media, which, as we have found, provides an excellent field for mis/disinformation. Suppose we know that social media platforms have the potential to spread misinformation by, for example, utilising captivating stories and impactful visuals [27, 28]. In that case, we should also present scientific data attractively and convincingly, especially since, as research has shown, on social media, "anti-vaccination clusters offer

a wide range of narratives, including safety concerns, conspiracy theories, alternative health and medicine, and even COVID-19-related narratives. In contrast, pro-vaccination views are more monothematic, lacking the diversity seen in anti-vaccination clusters" [29].

In that situation, healthcare professionals should familiarise themselves with social media platforms to enhance patient communication [30, 31]. According to Shoup et al., interactive social media interventions that achieve the most remarkable effects provide well-rounded information, acknowledge parental concerns, and avoid complex scientific terminology [32].

As healthcare becomes increasingly data-driven, data literacy will continue to be a vital skill for public health [33]. It gains importance even within the discussion on the data citizenship concept, which involves precisely the realisation of citizenship through the informed and judicious use of data [34]. Ensuring that the public can effectively interpret and use data connected with health is a challenge that requires concerted efforts from educators, health professionals, policymakers, and communicators.

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A Picture Paints a Thousand Words: A Case Study on the Use of Digital Media and Digital Storytelling in Three South African Universities

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Abstract. Storytelling has always been a way to convey a message, share information, feelings, and attitudes. The strength of digital storytelling lies in its ability to generate a series of cognitive metaphors and images associated with words to share content. Although the practice of storytelling in an African context has a rich oral and cultural history, the affordances of digital media are not yet fully realised in academic libraries. This paper reports on a study conducted in three universities to explore the current utilisation of digital media skills. The potential value of using digital media to support active learning in student communities was gauged. Qualitative data were collected from semi-structured survey questionnaires and interviews. Although research on the value of DST digital storytelling has been shared recently, very little has been reported on its application in academic libraries in South Africa. Findings are that the application of DST is minimal.

Keywords: Information literacy · visual literacy · metacognition · digital storytelling

1 Introduction

Digital media, such as DST (digital storytelling), entails the use of multiple digital software, devices, and platforms as a tool for learning. The value of using digital media in inculcating information literacy depends on its ability to generate a series of cognitive metaphors and images associated with words to share content. Globally, academic libraries expend great efforts towards enhancing information literacy and metaliteracy for higher education students. Academic libraries in the United States of America boast several examples of the use of DST in libraries. Storytelling has always been a way to convey a message, share information, feelings, attitudes, and morals of lived experiences and environments.

The rich oral tradition has in some cases transcended into the connected world, where storytelling is happening digitally with the use of a range of ICTs. Here, DST combines the art of telling stories with a mixture of digital media, including text, pictures, recorded audio narration, music, and video. In Africa and southern Africa information literacy workshops still concentrate mainly on using PowerPoint presentations where text is used

to share content during information literacy workshops. The practice of storytelling in an African context has a rich oral and cultural history, yet the value of digital media may not yet fully be realised and used with confidence in academic libraries. Although research on the value of DST digital storytelling has been shared recently, very little has been reported on its design and application in academic libraries in South Africa.

This paper reports on a study conducted in three universities to explore the current utilisation of digital media skills. The study explored the existing understanding and practices of DST among participants. The potential value of using digital media to support active learning in student communities was gauged. Qualitative data were collected from semi-structured survey questionnaires and interviews. Although research on the value of DST has been shared recently, very little has been reported on its application in academic libraries in South Africa.

2 Background and History of Digital Storytelling

Wu and Chen [1, p. 103786] share that DST originated from the community arts movement of the 1980s. The practice of DST emanated from the production of short, narrated films created during workshops at the Centre of Digital Storytelling in California. In these early days stories were often autoethnographic, with storytellers sharing personal accounts by using images and memorable life experiences. Then the technique of storyboarding and script writing evolved as short, narrated and often personal films [1]. Alexander [2] describes DST as narratives created from the cyberculture constructs, where the creators could either be professionals or novices. In essence, DST combines the art of telling stories with a variety of digital multimedia, such as images, audio, and video. In most cases digital stories are created by using a mix of text, images, digital voice recordings and narration, and even video and music to share information. As is the case with traditional storytelling, digital stories revolve around a chosen theme and often contain a particular viewpoint. Where digital technologies and narration meet, interactive and participatory mechanisms are created as powerful development tools in a connected world. The value of DST is a story waiting to be discovered further. One such example is the University of Nevada, Reno, where librarians are deeply embedded into the process of DST where various instructors in the college have begun incorporating DST into instruction in response to a broader push towards strengthening students' communication skills. The educational value and strengths of DST manifest in developing cognitive fluency. Cognitive abilities such as critical thinking, reflection, creative problem-solving, and reasoning in an academic learning environment allows for new knowledge creation through immersive experience for the recipient. Designed correctly, it has the potential to motivate, create interest and increase user-engagement for deeper sense-making. It is a tool that potentially could address the literacy challenges of the South African undergraduate student.

3 Literature Review

There is a paucity of reported studies on DST conducted in South African academic libraries. International studies, including the research of Detlor, Hupfer and Smith [3, p. 44] and Gowen [4, p. 3] propagate the value of DST in academic libraries to engage and

reach out to their communities. Gowen [4] explains that the academic librarian is ideally placed to accommodate and promote DST across disciplines, and stresses that cognitive science studies confirmed that narratives are easier to process and recall than just informational writing. Gowen [4] explains that engaging narratives retain information when stimulated in a story format. King [5, p. 24] adds that metacognitive development is influenced by student motivation and is most effective when information is of interest within a familiar learning environment where they are encouraged to become self-determined in taking responsibility for their own learning. The role that academic library services must play in enhancing metacognition is evident. But librarians need to be more proactive and participative as they form part of student learning environments.

3.1 The Nature of Digital Storytelling

The DST is not merely making use of one-directional predesigned videos for online tutorials. Narratives in DST often share personal accounts and views. They can also be interactive and participatory. Cognitive abilities such as critical thinking, reflection, creative problem-solving, and reasoning in an academic learning environment allow for new knowledge creation through immersive experience for the recipient. Designed correctly, it has the potential to motivate, create interest and increase user-engagement for deeper sense-making. It is a tool that potentially could address the literacy challenges of the South African undergraduate student.

3.2 The Role of Digital Storytelling in Education

Since its humble beginnings, DST has not only been applied effectively in areas such as marketing but is also becoming a valuable and popular tool in higher education in microlearning. With the developments of technology assisted teaching, we see a renewed awareness and interest in making use of DST. Typically, DST consists of short, two-to-ten-minute videos with a short and focused message of micro content. This form of communication proves to be highly effective for the needs of the new student generation, who experience the physical world and digital world seamlessly, preferring microcontent to long and wordy communication. Hug [6, p. 4] says that designing and utilising microcontent correctly could support micro learning as an ideal educational tool.

The strength of storytelling lies in its ability to create a meaningful series of images associated with words intended to share experiences intended for further collaboration. The question is whether the awareness and application of this tool is being used in a knowledgeable way and optimally in South African HEIs and particularly in academic libraries, tasked to support all literacies, including IL and metaliteracy. Recently, some universities have been incorporating DST, and it is supported and designed by instructional design teams, working closely with academics. The value for teaching and learning is paramount, particularly because of its engaging qualities that could further lead to motivate students. Globally, the use of DST to meaningfully relay difficult concepts to recipients and patients is being applied in Science, Technology, Engineering, and Math, including Computer Science (STEM) and Health disciplines. Ideally, students should be able to participate in the creation of digital stories.

Many academic library sectors have makerspaces or 'Fablabs', being digital fabrication spaces, where students can develop these and other digital skills, strengthened by multimodal experiences. This approach requires the ability to engage with digital technology for content creation while also understanding the affective impact of telling a story. Students use and enhance their critical thinking, as well as reading and writing skills during the creation of a story that ultimately plays out as a digital movie.

3.3   Digital Storytelling as a Medium to Enhance a Range of Literacies

Metaliteracy emphasises four learning domains: the cognitive, behavioural, affective, and metacognitive. Jacobson and Mackey [7] state that metaliteracy forms the foundation of a range of literacies including visual literacy, digital literacy and media literacy, among others. As a conceptual framework for information literacy, it enables the construction of networks, supports lifelong learning and literacy fluency. As such, metaliteracy combines the cognitive, behavioural, procedural, and motivational, and other practices towards more context-specific and context-appropriate practices. Fulkerson, Ariew and Jacobson [8] add that metaliteracy focuses on metacognition as well as the realisation that students are indeed creators of information during research and learning. Visual literacy entails experiences, attitudes and orientations that are shared via images, video, and other forms of multimedia. DST Digital storytelling requires high levels of visual literacy. The American Library Association (ALA), the Association of College and Research Libraries (ACRL) as well as the International Association of Visual Literacy (IVLA) describe and explain visual literacy. Visual literacy skills equip a learner to understand and analyse the contextual, cultural, ethical, aesthetic, intellectual, and technical components involved in the production and use of visual materials.

3.4   Mobile Technology and the Application of Digital Storytelling

Among the emerging technologies, mobile communication technology is growing at a rapid pace. Consequently, the use of mobile communication technology in education is increasingly becoming a reality [9]. Mobile technology is at the centre of new students' technology preferences [10], including its use for studying and accessing information. Mobile learning in higher education must be explored further, also as a tool for meaningful integration towards inclusive education and equity in delivery These devices include smartphones, tablets, e-book readers, handheld gaming tools and portable music players. The penetration of mobile connectivity in Africa is higher than internet connectivity [11], which may be a further factor in it being among the most used devices to access information at present. This makes mobile devices ideal to facilitate learning. In addition, the familiarity with their own portable technology helps students in accessing information quickly [12]. Mobile services include mobile-friendly websites or applications with access to the library's catalogue and online databases, text messaging services, e-books, and tutorials. Learning is optimised when distributed in manageable portions, opposed to it being delivered in one long continuous session. Mobile learning is a viable option for reaching targeted student audiences and convey digital stories for information and literacy support and development.

3.5 Designing and Creating Digital Stories

Libraries and storytelling have a rich history [3, pp. 43–68]. Yet, with technological and digital media developments not all libraries adapted to this trend of utilising new digital formats and options. In South African academic libraries, the use of storytelling has been limited. The use of digital media for teaching and learning support has only recently been introduced to academic libraries in Africa. Many information specialists did not have exposure nor training on the application and use of digital media. Literature alludes that DST digital storytelling has been incorporated in tertiary teaching and learning, but library and information services have generally been slow to make full use of this innovative avenue. Many academic libraries in southern Africa remain with the more traditional orientation and facilitation such as IL facilitation workshops.

In Fig. 1, (Adapted from Lambert, 2010) the seven essential elements that must be present in effective digital stories is presented. Lambert [13] divides the design of a digital story in two phases: The writing phase and the construction phase. The writing phase starts with a point of view that must be shared by posing a question. For effective connection with the indented recipient emotional content must be presented in the best way making use of the available time. In the construction phase the pace of the story is combined with the narrator's voice and sound effects to enhance the message.

All these elements must get consideration in even the shortest digital story. Although research on the value of DST digital storytelling has been shared recently, very little has been reported on its design and application in academic libraries and information services in South Africa. Digital storytelling requires the storyteller to think carefully and creatively about their message, which enhances the learning process by promoting information comprehension and recall. It also helps to develop the ability to appropriately evaluate and use online content and digital tools as a means of personal expression and growth. No technical background is required to become a digital storyteller, and anyone with a message and a little creativity can use it with great success.
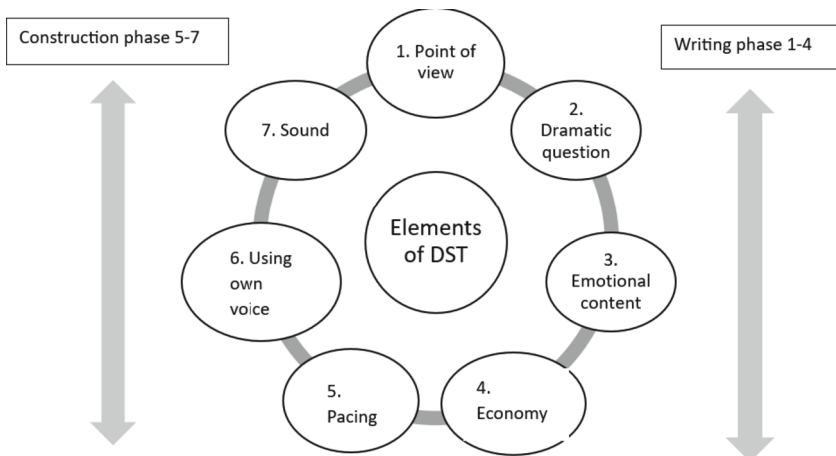

Fig. 1. The Seven Elements of DST (Adapted from Lambert, 2010)

3.6 The Uptake of Digital Storytelling in Libraries

Traditionally, libraries and storytelling have much in common. Yet, with technological and digital media developments not all libraries continued and evolved this tradition into utilizing new digital formats and options. In academic libraries the use of storytelling has been limited. The use of digital media for teaching and learning support has only recently been introduced to academic libraries in Africa. Literature alludes that DST (digital storytelling) has been incorporated in tertiary teaching and learning, but library and information services have generally been slow to make full use of this innovative avenue. DST is not merely making use of one-directional use of predesigned videos for online tutorials. Ideally, it should be designed to encourage participation. This seems to be the biggest misconception within the target group. Many academic libraries in South Africa remain with the more traditional orientation and facilitation such as IL deeply facilitation workshops.

4 This Case Study - Exploring the Use of Digital Storytelling in Academic Libraries

This paper addresses the perceptions, challenges, and experiences of academic information specialists on using the technique of digital storytelling, through the lens of critical digital information studies and informed by recent research into the potential value that this technique holds for the support of active learning in a diverse community. It explores the elements required of effective digital storytelling, as well as the skill sets required to develop such a product. The data were collected from three higher education institutions. The undergraduate profile of these three HEIs are similar, with all three offering qualifications in Social Science, Commerce, Education, Law and Computer Science. This study explored the current uptake of digital storytelling in academic library and information services, to build metaliteracy skills among undergraduate students. It explored prevailing perceptions, challenges, and experiences of academic information services on using the technique of digital storytelling. It investigated the elements required of effective DST, as well as the skill sets, and infrastructure required to develop such a product. The paper reports on how the information professionals understand what their role is in supporting literacies. It further unpacks and analyses the existing design skills among information specialists.

5 Research Design

This research followed a case study design, and was used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. This design is naturalistic and follows an interpretive design of an existing complex phenomenon (as explained by Noon [14, pp. 75–83]. This study explored the status of digital storytelling at the selected institutions' academic library services. The study focused on how and if the art of digital storytelling was deployed as part of teaching and learning support of undergraduate students. This design was chosen as it allowed for consideration of the actual experience and input of the target group as a unit. It allowed for observation and discussion of a

real-life environment in its natural setting. This study follows a deductive approach. Often contrasted with an inductive approach, deductive reasoning is a logical approach commencing with a general idea, considering studies and theories and then deriving specific conclusions. In this case, the use and perceived value of digital storytelling in higher education is explored to answer the research question: "What is the uptake of DST in the selected academic libraries?".

Through the lens of multiple frameworks and informed by recent research, the study looks at the potential value that DST as a technique holds for the support of active learning in a diverse and unequal landscape. Pangrazio [15, p. 163] warned that the disruptive and evolutionary changes in technology make it ever more important to reconsider what 'critical digital literacy' is in students' digital practices. The research design of this study is rooted in the interpretivist paradigm, where the analysis of qualitative data is analysed to provide answers in a real-life context. As for this case, research sub-questions were:

- Do the participants understand and exploit the affordances of digital storytelling as part of the teaching and learning support in South African higher education?
- Is this tool and resource being used to support and develop self-determined students and informed students in an ecosystem that proves to still be largely unequal?

5.1 Data Collection

The non-probability sample was purposely selected, consisting of a private university, and two comprehensive universities in South Africa. The participants were selected based on the role and function that they play to facilitate teaching and learning support, and their involvement in the design and facilitation of programmes to enhance information and other literacy workshops. Qualitative data, by means of convenience sampling, were collected from open-ended, semi-structured survey questionnaires, and followed up by in-depth interviews with senior managers. The qualitative data collected were analysed using thematic reflective analysis. Vaismoradi et al. [16, pp. 100–110] state that qualitative research, as a group of approaches for the collection and analysis of data, aims to provide an in-depth, socio-contextual and detailed description and interpretation of the research topic. The socio-contextual nature of this study considers the profile, background and needs of undergraduate students in South African HEIs, where social justice and social-metacognition have been known as fields requiring deeper research.

As part of the case study library managers, policy and procedure documentations were analysed as well. Group interviews with individual HEIs were conducted to further interrogate current practices, and to get further data on questions not fully clarified in the survey questionnaire. Semi-structured group interviews were conducted with library management and staff members responsible for technology assisted facilitation of various literacies for undergraduate students. In total three (3) participants from each HEI responded in answering the online survey questionnaire, making the total sample size nine (9) participants.

Collected data were analysed thematically. Thematic analysis is a technique for analysing qualitative data that entails searching for and analysing repeating patterns in a collection of data, as well as reporting on them [14, pp. 75–83]. It is a data representation approach that also involves interpretation in the form of resolving codes and theme creation. Themes that emanated after data were analysed and coded were:

- Lack of innovation and renewal of existing practices
- Multi-modal information literacy facilitation opportunities
- Lack of institutional support and resources
- Multimedia and technological skills gaps
- Transboundary collaboration with faculties and academics
- Lack of innovation and managerial foresight
- Knowledge of the nature and application of metacognition and metaliteracy

6   Findings

In analysing the collected data from both the questionnaires and the interviews it became clear that the notion of DST is underdeveloped in the target groups of this study. The findings are presented in accordance with the themes identified, namely:

Innovation.   When the concept of DST in an academic environment was first introduced to the participants there was a feeling that this does not belong in a tertiary environment, pointing to the lack of familiarity with the concept. Findings are that the use of DST in this study is limited and sporadic, and when it is used on the rare occasion, it is mostly for library marketing:

Technology, DST and Multimedia Skills Gap.   All participants conceded to lacking the foundational skills, knowledge and understanding of designing and using a digital story. In addition, none of the HEIs had a grounded understanding of metaliteracy nor their role in supporting the development of a range of literacies. And admitted that they are still conducting literacy unchanged these past two decades, utilising text-heavy PowerPoint presentation with limited use of digital storytelling techniques. The participants all lamented that available training does not include the use of DST as a medium to support information literacy. One participant commented: *"We mostly use PowerPoint presentation when we present information literacy workshops" [P. 2].*

All participants shared that they were not aware of plans to embark on developing capacity to include multi-media and DST in their information literacy programmes any time soon.

Lack of Institutional Support.   One participant shared: *"A while ago we developed a TikTok video, but it was retracted by our Marketing Department" [p. 4].*

Two participants conveyed that they were asked to discontinue the creation of DST videos as the HEI did not have the necessary policies and guidelines in place. The reason was that the online commentary could not be predicted and controlled.

Transboundary Collaboration.   During the interviews it was affirmed that there is little to no collaboration with faculties teaching academic literacy for undergraduate students, which is an indication that efforts to develop composite literacy qualities are not managed optimally. Collaboration with instructional designers and faculties are minimal. This corresponds with the findings of a study by Derakhshan and Singh [17] lamenting that academics distance themselves from libraries' efforts to develop information literacy skills and fluency.

The participants further shared that their HEIs all have instructional designers responsible for creating storyboards and digital material, but that these were mainly used for discipline-specific instruction. One HEI shared that their Marketing Department makes extensive use of DST with narrations of alumni on their success stories. They continued to say that there is limited collaboration between the library and other departments such as Marketing, and that funds and other resources were not prioritised for the promotion of information literacy. The value of DST as a digital participatory tool is lost.

Multimodal Information Literacy Facilitation. The educational value of DST in this study is unexplored. DST is not applied and used innovatively to expose students to other forms of literacies such as visual literacy and media literacy. The existing DST videos are also not collaborative or interactive. Despite the myriad of recent technological advances in academic library services, it appears that information specialists may still feel ill-prepared. The question is why an area well-documented in information and knowledge management, and akin to traditional library services would result in this level of hesitation and digital resistance.

Metacognition and Metaliteracy. Additionally, concepts of metacognition and metaliteracy are familiar to the participants but are not exploited to harness self-determination in undergraduate students. Participants conceded lacking the foundational skills, knowledge and understanding of designing and using a digital story. They further shared that their HEIs all have instructional designers responsible for creating storyboards and digital content, but that these were mainly used for discipline-specific instruction only. None of the HEIs had a grounded understanding of metaliteracies and admitted guidelines towards best practice models in enhancing visual literacy. The case study, however, found that the academic libraries want to make better use of DST and that they are ideally situated to take the lead and introduce the concept. In preparation for this approach, they need more guidance and training.

7   Conclusion and Recommendation

In answering the research question on the current uptake of DST in the study, it is evident that participants have a good understanding of the importance of improving current information literacy programmes. They are eager to explore the affordances of DST. The most important barriers experienced are lack of training, lack of resources and support.

Many South African students have poor reading skills, and they also have an aversion to reading, which is a barrier in education. DST can address this problem. Much more research is needed to understand and address this dilemma better. Based on the findings and substantiated by literature reviews this study concluded that DST has enormous potential to assist undergraduate students. This study however found that the academic libraries targeted in this are ideally situated to take the lead and introduce the concept of DST. In preparation for this approach, they need more guidance, advocacy and training.

An awareness of the affordances and the nature of DST must be developed in HEI library services in this study. DST is not merely making use of one-directional use of predesigned videos for online tutorials. The value of DST as a digital participatory tool

is lost. When the concept of DST in an academic environment was first introduced to the participants there was a feeling that this does not belong in a tertiary environment, pointing to the lack of familiarity with the concept.

The value of the study lies in adding new knowledge on how new technologies can be used to change old practices. The study warns that where literacy facilitation is still offered in the form of one-directional PowerPoint presentation, the value is limited, and the use of digital storytelling techniques should be explored.

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Supporting Students' Digital Literacy

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Abstract. In 2021 the Norwegian government launched its "Strategy for digital transformation in higher education 2021–2025", and in 2022 an Action plan was launched. The goal is a more digitally competent workforce. We share experiences from the University of Bergen Library, and the University Library at UiT The Arctic University of Norway. In Bergen, an online course for first year's students teaches them to navigate critically in a world of facts, opinions and arguments, while UiT Library has developed iKomp. The main purpose of the course is to make students well equipped to meet the demands and expectations of universities and colleges regarding learning, academic integrity, and use of sources. We compare the two approaches through a qualitative cross case-comparison, investigating scope, learning goals and other relevant aspects, and reflect on the strengths and weaknesses of the courses, and we give recommendations for development of information literacy training.

Keywords: Norway · university · academic libraries · training · digital literacy · information literacy · digital citizenship · source criticism · students · learning strategies · academic integrity · online learning

1 Introduction

In two recent white papers on higher education from the Norwegian government, a focus on generic skills is emphasized. "Those who are students today will be involved in developing the labour market of the future with their professional expertise and generic skills such as critical and analytical thinking, information processing, and innovation and entrepreneurship." [1] and there is a clearly expressed message that education needs to be more than just discipline based: "The education programmes need to impart specific as well as generic knowledge and skills" [1]. As a society we need citizens with interdisciplinary competencies and generic skills to be more robust in meeting technological and organisational changes in our work life and be able to participate in lifelong learning [2].

1.1 Open and Flexible Education

When the current government made their declaration of intent in the "Hurdalsplattformen" they promised to pursue an ambitious and aggressive knowledge policy and build strong, high-quality professional education throughout the country. They wanted to strengthen the regional educational offers to make education and lifelong learning available where people live. This would make it easier for people to get additional skills and more education, while companies and municipalities can recruit more widely and gain access to more professionals. As part of the follow-up of this policy, the government has increased the funding of higher vocational education [3].

The Norwegian government launched its "Strategy for digital transformation in higher education 2021–2025" [4] in September 2021, and in November 2022 the Action plan building on this strategy was launched [5]. The strategy and action plan focus on students and academics, and their need for more competencies and enhanced practical knowledge in information technology. The end goal is a more digitally competent workforce.

Drawing on the experiences from the Covid pandemic, the government recognises that there is still a way to go before digital tools provide the increase in quality in education that they foresee as necessary. At the same time, there is great potential in making better use of digital tools in the university and college sector.

Universities and colleges must therefore adapt to take better advantage of digital technology. Going forward, it will be important to continue the work to further develop quality in education, research, and innovation. The institutions must also contribute with new study programs and the knowledge and understanding necessary to exploit the opportunities and meet the challenges that digitisation brings.

In the strategy, six areas are elected. For each area of effort, some main ambitions for the work have been determined. Challenges, opportunities and gains as well as assumptions are then described, and finally areas of action follow up on the main ambitions. Most of the action areas require effort and action under the auspices of the universities and colleges themselves. The universities and colleges have different profiles and different starting points for the digital transition. For some areas of action, it will be beneficial to have collaboration and joint solutions across the institutions.

The main areas are:

1) Digitization for flexible education
2) Digital innovation in teaching and learning
3) Digital topics, methods and expertise in all subjects
4) Open research and new research opportunities
5) Exploit data about the knowledge sector
6) Management and culture for digital transformation

The action plan contains measures under each of these headings, both existing measures from the current strategy/action plan, and new ones. It also contains descriptions of best practices from the Norwegian higher education institutions.

The strategy and action plan are closely related to various European Union initiatives [6, 7], and also links to the overall plan for digitalization of Norwegian society [8].

1.2   The European Union Initiatives

The European Union's Digital Education Action Plan (2021–2027) [6] builds on the first Digital Education Action Plan (2018–2020) and contains two strategic priorities: 1) Fostering the development of a high-performing digital education ecosystem and 2) Enhancing digital skills and competences for the digital transformation. The plan includes 14 actions to support the strategic goals. This plan was developed in response to several challenges in the EU, both concerning the aftermath of the Covid19 pandemic, and the ongoing shift in the economy. Some of the background includes:

A study from the Organisation for Economic Co-operation and Development (OECD) in 2018 found that on average less than 40% of educators across the EU felt ready to use digital technologies in teaching, albeit with divergences between EU Member States [9].

More than one third of 13–14-year-olds who participated in the International Computer and Information Literacy Study (ICILS) in 2018 did not possess the most basic proficiency level in digital skills [10].

A quarter of low-income households have no access to computers and broadband, with divergences across the EU affected by household income [11].

95% of the respondents of the Open Public Consultation of the Digital Education Action Plan consider that the COVID-19 pandemic marks a turning point for how technology is used in education and training [6].

In "A Europe fit for the digital age" [7], the EU focuses on various areas of society: Digital Services, Digital Markets, European Chips, European Digital Identity, Artificial Intelligence, European Data Strategy, European Industrial Strategy, Space and European Defence. However, the most interesting action for this paper, is the proposal from April 2023, addressing the two main common challenges identified: 1) the lack of a whole-of-government approach to digital education and training, and 2) difficulties in equipping people with the necessary digital skills. The proposal aims to foster the development of a high-performing digital education ecosystem and thereby enhance digital skills and competences for the digital transformation.

Neither the EU or the Norwegian strategies, nor the action plans mention academic libraries specifically, but within the actions, there is room for relevant interventions where academic libraries can take a leading role.

2   Two Online Courses Targeting New Students

Two Norwegian academic libraries that have developed services addressing some of the challenges identified in these plans and strategy documents are the university libraries of Bergen and Tromsø. As with many other academic libraries, these work with supporting teaching and research through a series of services where traditional library help intersects with learning strategies, computer skills and information literacy.

2.1   Case 1: Course Digital Source Criticism

Digital source criticism [12] is an online course launched in 2022 from the University of Bergen Library. This is a short online course, primarily targeting first years students,

teaching them to navigate more critically in a world of facts, opinions and arguments shared in everything from social media to academic textbooks. The three-module course follows a case regarding the increasing amount of plastic waste in the sea, and how both research and what seems to be research about this find its way to the debate. It introduces students to basic source critical competence toward media and non-fiction. Students learn how to navigate scholarly sources, and reuse text and illustration in their own work according to academic standards.

The course is part of a larger effort by the university to strengthen the student's digital competences and understanding by learning about artificial intelligence, privacy protection, ICT security, programming and algorithms, and understanding and use of data. The course package is targeting new students to the university, but available for students at all levels.

Learning Goals. *Digital source criticism* is based on learning goals concerning specific knowledge, skills and general competence concerning this topic:

Knowledge. After the course, students will have a basic understanding of scholarly thinking and scientific communication channels. They will have knowledge of how science that is communicated and retold through different academic genres and media can be sought out and assessed. Students achieve:

- basic knowledge of scholarly ideals.
- general knowledge of source criticism, critical reflection on science and dissemination of science.
- basic knowledge of copyright rules.
- knowledge of how to use others' work in one's own work, including why and how to refer to others' work and reuse illustrations.

Skills

- After the course, students will be able to find, evaluate, and reuse sources according to academic practice.
- The students gain skills to use the SIFT method [13], including lateral reading, and checklists for evaluating scholarly information in different media.
- Familiarise oneself with the collection of literature and sources via relevant search tools.
- Be able to cite sources according to academic expectations and standards, regardless of subject.

General Competence. After the course, students will have built up an understanding of scholarly attitudes and see the importance of a source-critical perspective on all information, regardless of subject, medium and methodology. Students will understand what it means to be part of the academic community.

Attendance and Feedback. Registration for the course is neither compulsory nor gives any credits, hence itherewas a modest response the first time it was made available with the other courses in this programme. 160 students were initially signed up for the first

semester but only 60 percent completed the course. Those completing it did however give valuable feedback, and a majority of these pointed out a) source criticism, b) the library search engine to digital and printed materials and last c) citing sources to have been the three most important topics throughout the course.

The course takes between three and four hours to complete and is available on the university's LMS, which is based on Canvas. The course considers multiple learning types, such as reading text, watching short videos, listening to podcasts and not least completing exercises throughout the modules.

Future Development. Evaluation and feedback from prior and future course participants serve as a basis for further developing the course. In addition to the existing three modules, a new module is under development covering what to be aware of if utilizing AI chatbots in academic work. It will also be translated and made available in English. This development has received funding from the National library in Norway. Students were initially involved when the course was sketched and developed, and they will continue to be involved for the next versions as well.

The strength of this course is the online availability for those who sign up, as it only needs to be completed sometime before the semester ends. For those taking the course, they later get access to a toolbox with the most essential information which they can make use of later in their studies.

The most pronounced weakness is the limitations and plain design of the LMS on which it is available. The university has chosen an open-source version of Canvas which has many limitations. Ideally a more suitable platform together with professional design would give the content a much better presentation and user experience. Last, not being compulsory nor giving any formal credits to the students, the course might attract those already interested and aware of the many pitfalls concerning source criticism and evaluation, and not necessarily those who need it the most.

2.2   Case 2: Course Ikomp

Ikomp [14] is an online information literacy course developed at the UiT The Arctic University of Norway Library. It is designed to help students navigate the various demands they meet concerning academic integrity and information use. The course specifically targets first year students but can be used as a handbook throughout their studies. The reason we see Ikomp as an important part of students' generic skills is that even though many students are digitally adept, they often find it difficult to identify what constitutes quality in scholarly sources. In addition, they do not necessarily reflect on the processes that lies behind the creation of information sources and thus might fail to recognize when a source is created for other purposes than presenting facts and real research.

Ikomp was originally launched in 2015. It was a continuation of and a supplement to our face-to-face teaching in information literacy and partly a result of the growing complexity in accessing and handling information with which we could see first year students struggling Another reason for creating the course was the increasing diversity in the student demographic. With more and more students seeking higher education we see the student group becoming less homogenousin aspects like social background,

motivation, age and geography. A third reason for the birth of Ikomp was the structural changes that have taken place in Norwegian higher education the last 15 years. UiT has during this period merged with several smaller university colleges spread over a large geographic area. At the moment UIT has four campuses, and an additional 7 teaching locations, and to be able to reach students in all these places, it was necessary to create an online course.

According to the Regulations for studies and examinations at the University of Tromsø - The Arctic University of Norway, "Teaching and guidance on information literacy shall be given as part of the first semester courses." [15] Ikomp thus fulfils a requirement of the bachelor degree. The individual departments can of course opt to provide the teaching of information literacy themselves, but many choose to use Ikomp and the library for this task.

Learning Objectives. Ikomp is based on a rather broad definition of information literacy, where several generic skills like critical thinking and learning strategies are included. The four modules are:

- information evaluation
- learning strategies
- the information searching
- academic integrity.

Each module contains text and video and various activities, including self-tests. The course is made on the open-source platform, OpenEdX and is free and available for anyone interested. It is available in Norwegian and English and can be taken at anytime and any place that suits the student best.

Some of the learning objectives of the course are:

- choose information sources with regard to relevance and need
- know and be able to use criteria for evaluating the quality of information
- use self-testing and in-depth questioning to support to learning
- read effectively to identify the main message and arguments in texts written by others
- choose suitable search tools for different purposes
- determine what needs, and what does not need, source references
- plan a good search strategy that results in an effective search for information
- correctly refer to different types of sources, both in the text and in the reference list

At the end of the course, students can take a multiple-choice exam, and will need at least 80% correct answers to pass. The course certificate can then be uploaded to the students' learning management platform, like Canvas. Some departments have made Ikomp a compulsory work assignment for their first-year students, thus making sure that all students get a basic training in information literacy skills. Others list it as a recommended work assignment. This means that the course is used quite a lot in a variety of disciplines.

In 2022 we also launched a version of Ikomp designed for pupils in secondary education. It is built similarly, but with a focus on a younger audience, and with an additional part for teachers. The course includes both learning objectives and take-home

messages like this one from the source evaluation module: "We are inundated by fake news and alternative facts. We all need a solid toolbox to avoid being influenced by incorrect and/or false information." The module for teachers includes several suggestions on how to work with information literacy skills in class in for instance social sciences, history, or language lessons.

The flexibility of an online course is one of the strengths of Ikomp. Students can take it when they need it, or when they have to, and they can take it at any time and wherever they happen to be, as long as they have internet connectivity They can also jump back and forth between the modules, and revisit certain aspects when necessary. But most of all, the course gives new students a basic introduction to a set of generic skills necessary to succeed as a student, and increasingly so, skills also useful as part of being competent citizens.

The drawbacks with online courses compared to face-to-face teaching is the time it takes to implement changes in the course. Since it is a compulsory work requirement for many students, we cannot make changes to the course in the middle of the semester. Major changes include making new videos and creating new activities,and this takes time, so every revision must be carefully planned. This year, we have received a suggestion on including a module on academic writing in the course. Furthermore, since the introduction of ChatGPT and other artificial intelligence tools last year, some departments look to the library for support on how to deal with student's use of AI. Skills like source criticism have suddenly become more relevant than ever before. We are not planning to create an Ikomp module on AI, but it will have to be integrated in the modules on academic integrity and evaluation of sources. The course is in the process of being revised at the time of writing this paper.

2.3 Course Comparison

Having presented the two courses' scope, learning goals, content, and experiences so far, this section seeks to compare *Digital source criticism* and *Ikomp* through a qualitative cross case-comparison [16].

As Table 1 illustrates, the two courses differ in many aspects, but both focus on teaching a set of generic skills to students. These skills are increasingly relevant in our technology-rich societies not just to succeed in academic studies, but also to meet the demand of employers. According to a definition by UNESCO, 21st century skills are necessary to "fully participate in and contribute to the knowledge society. … in the information or knowledge society the development of conceptual and metacognitive knowledge is increasingly considered important." Among the specific skills mentioned are, for instance, communication, ICT literacy and critical thinking [17]. Both courses recognise in other words the need to help students access, process, evaluate and use various information sources, both as students and as citizens.

Both case courses have been developed by local teams consisting of five to six subject librarians, normally giving first year students face-to-face courses on information literacy. Production of films was outsourced to other staff at the two universities when necessary. Case course 1 *Digital source criticism* utilized the sprint methodology first time the team gathered to start their work on the course. This enabled good discussions about the objectives and content, but also included interviews with relevant stakeholders

Table 1. Comparison of case courses

	Case course 1	Case course 2
Name	Digital source criticism	Ikomp
Launched	2022 Fall	Spring 2015
Main target group	First year students	First year students
Attendance 2022	140 completed	4744 completed (2021)
Learning forms	Video, text, tests, podcast	Video, text, tests
Platform	LMS Canvas	Oped EdX
Availability	Enrolled students	Open to anyone
Course duration	3–4 h	5 h
ECTS	None	None
Language	Norwegian*	Norwegian and English

as students, lecturers, and colleagues. Similarly, case course 2, *Ikomp*, made good use of stakeholder groups throughout the creating process, and among other things, had a test panel of students commenting on early drafts of the course.

Looking at what the two courses have become, both projects have been a success. Students from all disciplines now have a flexible possibility to increase their knowledge concerning information literacy and source criticism from the very beginning of their studies.

Challenges concerning such projects are both the amount of time it takes to develop it and later doing updates. Discussions, production, and redesign are always much more comprehensive than one might expect in the beginning since the topic is well known to the creators. Case course 2 *Ikomp* is more established than case course 1 *Digital source criticism*, but both see a constant challenge promoting and recruiting to their target groups. Ideally such courses have stakeholders throughout the institutions, to increase awareness and make implementation easier.

The courses receive feedback from participants, and suggestions for adjustments are considered by the developers. Case course 1 is yet to be translated to English, to reach a broader audience including the international students. The breakthrough of AI chatbots such as Bing chat and ChatGPT has raised many challenges to the scholarly community and the courses will have to be revised accordingly.

Even though neither *Digital Source Criticism* nor *Ikomp* give formal credits, one of the main differences is the way Ikomp has been made compulsory for many students at UiT. This means that more students get an introduction to a field they might not have sought out otherwise. As is to be expected, students are very economical with their time and effort, and very often choose not to spend time on non-credit assignments. In addition, many young people believe themselves to be information competent, without having a proper grasp of what the concept involves. It is thus highly recommended that generic courses like these are easily integrated in the degree system of the institution.

The openness of *Ikomp* also invites to use outside of UiT, and studying usage data shows us that the course is used by students all over Norway.

3 Recommendations for Development of Next-Generation Information Literacy Training

To develop and launch an online course that aims to replace or enhance face-to-face sessions, there are several experiences and recommendations to share. The team should be diverse, covering all skills and competencies necessary. Technical skills of for instance, production of films must also be considered if such content might be included in the course. Students are quite "spoiled" with user-friendly interfaces and easy access, so the design of the course must be carefully considered. The *Ikomp* team used in-house graphic design competence, which helped improve the user experience. Next, the team must have enough resources to create, maintain and update the online course. Creating an online course takes much longer than you think, at least if you are working on it in addition to doing your ordinary job. Getting the content together, choosing and managing the right platform, piloting and testing and revising takes at least 6 months, probably closer to 12, depending on the size of the course. Also, students should be involved and give their opinions as early as possible, ideally when the course is just a sketch on the storyboard. This makes any adjustments much easier than starting a redesign later. Next, involve faculty members or key personnel outside the library as stakeholders. Both for input and involvement of the course. This might also give the course an easier implementation as promotion is both challenging and time-consuming. Last, we would recommend reusing material, such as videos, already available from other institutions. There is no need to produce everything yourself to illustrate a point. This can be done at a later revision if considered necessary.

From what we have seen so far, it is important to integrate digital and information literacy skills in the curricula of first-year students. It seems that with the swift spread of artificial intelligence tools, the need for skills in critical thinking and source evaluation is more important than ever before. Whereas earlier training in digital and information literacy very often focused on finding sources and using various databases and other kinds of technology, what we see next is that finding is no longer a key aspect. Even the writing and structuring of academic texts might be less of an issue as artificial intelligence gets more widely used. Critical thinking and analytical skills, will, however, be fundamental to both students and teachers if we are to interpret the current trends in the world of information technology. For librarians and other information specialists, this means both educating ourselves and increasing our own skills and, most importantly, reaching out to our stakeholders with this essential message.

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'New Clicks': Developing User-Led Digital Literacies in Older Adults Within Scottish Public Libraries

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Abstract. Digital skills deficits and their resultant real-world inequalities are keenly felt by an older adult demographic, and in Scotland at present there exists no definitive programme to bridge these ever-widening gaps. Using a Participatory Action Research methodology, this project will engage with an established older adult cohort from within the Scottish public library sphere to foster new approaches to developing critical digital literacy skillsets. This methodology will utilise longitudinal engagement and will assess outcomes against existing high-level information literacy frameworks. The outcomes suggested by this research will be robust, scalable and developed directly by those most affected by the issues being addressed.

Keywords: Older adults · digital · literacies · libraries · participation

1 Background: Older Adults and Digital Deficits

It has been argued that our present 'digital-by-default' society structurally supports inequalities at both micro and macro levels [1], where users without the requisite literacy skills and access to resources that enable maximum involvement, or even just participation, in this vast digital world are at an increasingly severe cultural and economic disadvantage. Contemporary research bears this out, showing that 'significant existing inequalities in access to learning opportunities' [2, p. 569] mean that often only those from stronger educational backgrounds and who live in stable socio-economic conditions develop meaningful, evolving and lasting digital skillsets [3].

These disparities are particularly keenly felt in an older adult demographic and population, who while cognizant of the benefits an enhanced use of technology and its attendant digital literacies can bring [4], nevertheless have also shown that a seemingly intractable set of structural issues often related to their age cohort – socioeconomic status, health challenges, a mistrust and misunderstanding of the role technology – mean that the quality of their tangible access to digital resources is often negatively impacted by these [5]. Reduced levels of effective digital literacies have been shown to be most prevalent in older adults from lower socioeconomic and health-challenged backgrounds [6]. Studies have also indicated that whilst high-level digital literacy skills are linked to

subjective feelings of well-being in older adults the reverse is also true of poorer and more restricted skillsets within this age group [7]. Older adults are also less likely to keep up to date with new, emerging and ever-expanding technologies, and so will fail to maximize the potential benefits of these in any meaningful way [8]. Moreover, a lack of sufficient awareness, knowledge and confidence in what literacy skillsets are even needed to thrive in our wider current civic and economic digital environments has been shown to only compound these attendant inequalities further [5].

These macro-structural, cognitive, technological and literal factors all combine to ensure that 'those who are older…benefit least from engaging in learning online, in terms of the personal learning benefits they achieve and the wider capital enhancing benefits they report' [2, p. 579]. They also perhaps unhelpfully 'emphasize a heterogeneity' [7, p. 16] of life circumstances and experiences of an older age cohort in relation to digital literacies, and fail to account for inherent differences therein which must also be considered on their own merits and which point to the 'socio-ecological, lifestyle and life course aspects of digital learning, skills, literacies and participation' [7, p. 17]; ageing therefore is a very complex and non-uniform process [9]. Such is the prevalence and variety of these structural constraints within our present society though that older adults are at risk of being left behind in a dominant 'era of compulsory computing' [10, p. 4], the ultimate results of which mean in a very real way 'that exclusion from the digital world increases our sense of isolation and limits our life chances' [11, p. 6]. Digital users - and older adults in particular – therefore not only need to foster ever-evolving *intersectional* skillsets in order to keep pace, but they must do so against a backdrop of endemic constraint, change and challenge. These 'sociological concerns' at the centre of digital literacy education are therefore key to understanding how and why older adults often find themselves suffering 'inequalities and injustices associated with the use of technology' [12, p. 489] in our world today.

2   Current Provision in Scotland and the Wider UK

Much work at civic and governmental level has gone into addressing these central issues of improving wider digital literacies in recent years, all with differing perspectives and outcomes. In UK-wide terms, standards and frameworks defining the essential 'skills needed to safely benefit from, participate in and contribute to the digital world of today and the future' [7, p. 2] have given high-level outlines of the literacy skillsets considered by central government as being critical to users' effective digital engagement [13]. From a Scottish perspective, current governmental emphasis is a multi-faceted approach focused on the access, design, efficiencies and cultural transformation of digital technologies [11] as well as the delivery of these 'on the ground' by a range of partner groups and organisations [14]. Third sector bodies have also recognized the importance and impact of developing essential digital skills, particularly when working with the most vulnerable members of society [15–17]. Scottish civic institutions have similarly placed an enhanced digitally skilled workforce at the heart of national economic development strategies [18], whilst the Scottish educational curriculum has long-since been focused on 'developing digital skills that are vital for life' for young people across the country [19]. In short, (digital) literacy is conceived as a core competence for citizens of all ages living in today's mediatized and digitised societies' [20, p. 38].

Yet notwithstanding these measures, recent research has shown that around 22% of adults in the UK still 'lack both the digital basics and the essential digital skills for everyday life' [21, p. 4], with those in older age ranges disproportionately affected herein [10]. Despite the almost-wholesale conversion of social, civic and economic services to a digital-by-default status in the past decade or so, 'the government has not provided a systematic means to ensure that people who lack digital skills can actually access services' [10]. Furthermore, as Richardson (2018) pointedly states:

'Policymakers and practitioners have a responsibility to ensure people of all ages have the critical understanding skills they need to use the internet in ways that enable them to act effectively in their own self-interest' [15, p. 50].

Additionally, while at present some existing third-sector strategies do focus on the development of fundamental practical digital skills for older adults in the UK [22], these are singularly-focused 'silo based' models and do not directly address wider concerns around intersectional and equally-critical digital information and media literacy skills. In turn, such limited existing provision conversely 'offer(s) the opportunity to develop and support initiatives that bring (digital) media literacy together with data and (practical) digital literacies' [23, p. 42].

Taken cumulatively this highlights that at the moment there exists no specific, tailored, targeted and critically *holistic* policy or strategy in place to support the sustained development of digital literacy competencies in older adults in Scotland or in the UK as a whole, despite this demographic being most at risk of developing negative life experiences as a result of such entrenched digital skills deficits [24]. A continuing lack of strategic focus on raising digital literacy competency standards in older adults at scale, similar to that already in place for school pupils and those of working age, could therefore be argued to only enforce present inequalities and to further limit the participative life chances of those directly affected by this.

This doctoral project will therefore seek to address this key issue, in tandem with Kebede et al.'s (2021) assertion that:

'Future research and practice should focus on tailored interventions accounting for the barriers to older adults' digital engagement and addressing capabilities, motivation and opportunities (herein)' [25, p. 1].

3 Scope and Rational for Development

It is important therefore as a starting point to consider what the development of any such strategic focus here could look like. Those policies currently in play to develop digital literacy competencies in other sectors of society centre around what Eynon & Malmberg term the 'responsibilisation of the individual', meaning that the 'responsibility for learning is held with the individual as they are the ones likely to benefit economically from engaging in such activity' [2, p. 3]. Such approaches neglect to address the peculiar structural compound circumstances experienced by older adults, particularly that 'people enter other and more disadvantaged statuses as they age' [9, p. 3] and that targeted and tailored models of engagement have proven to work effectively for this particular cohort [7]. At the moment therefore, our present collective efforts to address inequalities in the development of digital literacy competencies seem to be piecemeal and privilege

individual 'agency' over organised or planned 'structure', and the limited interventions they do offer specifically in relation to an older adult cohort sit uneasily when shorn of the contextual peculiarities associated with this demographic [7]. To be effective, any developed policies in this field must arguably therefore be structured, user-led and participatory by design especially for the complex needs of older adults, in order to maximise the scope and sustainability of their impact.

Indeed recent studies have shown that ways of 'empowering older adults with digital skills through learner-centred approaches on a need-to-know basis should be promoted' [25, p. 13]. Such approaches would 'generate reflections and opportunities that matter' in the specific context of enhancing digital literacy competencies for an older age group, as well as paying 'constructive and creative attention to people's aspirations and values' [26, p. 5] as a key component of their provision. In particular, Participatory Action Research (PAR) frameworks and peer-to-peer supported methodologies could develop digital literacies in engaging, creative and sustainable ways and, led by and with the involvement of users themselves, 'create a new capacity of a kind that may be able to reach those who would not be engaged by support which is otherwise too formal, unknown or geographically distant' [15, p. 48]. Recent studies have illustrated that such approaches have 'unique advantages for older people' [15, p. 47] and can be more engaging, effective and relevant for their participants when measured against more 'traditional' formal educational structures [20]. Indeed, pairing notions of user-led PAR approaches alongside the peer-supported ongoing development of these is an underexplored and potentially decisive form of engaging older adult users in the development of digital literacy competencies that crucially are directly relevant to themselves.

It is arguably evident therefore that only with the central involvement of those directly impacted by the development of such strategic focus – at all stages from conception to implementation and ongoing support – that any resultant outputs will be effectively applied, consistent and sustainable. Applying a PAR theoretical framework here could therefore potentially offer a breakthrough approach to developing such digital competencies in older adults in meaningful ways, because as Tretham et al. (2018) state:

'a PAR methodology offers a conceptually consistent research approach with transformative aims, where value is placed on enabling senior citizens' participation in leadership roles as both advisers and investigators' [27, p. 175].

Under these circumstances PAR theoretical models offer 'structural transformation and empowerment for older adults' [8, p. 328] and so would also directly address the peculiar literacy needs associated with this particular demographic cohort.

So in essence, such structured, participatory and peer-supported approaches here would therefore seek to ensure that 'digital support is less about the 'digital' than it is about people' [10, p. 10] and that by employing participatory action research frameworks and ongoing peer-support the digital literacies of older adults in turn may be improved crucially *on their own terms*. After all, 'a user-designed curriculum is more likely to be based around real needs and interests rather than what older people 'should' want to learn online' [15, p. 47].

4   Public Libraries as a Progressive Vehicle

As 'longstanding hubs for literacy' public libraries are 'logical places to promote digital literacy' [10, p. 22] and especially so for older adults who disproportionately make up the bulk of their user-base [10, p. 16]. Indeed as the older adult demographic only continues to grow in the UK alongside their attendant specific digital literacy needs, 'public libraries are uniquely situated to respond' to these challenges and to the opportunities they present in turn [2, p. 6]. Public libraries act as a bridge across the digital divide [10] and while multiple studies have shown that they are a trusted civic institution and critical community hub [28, 29] they are also seen as a safe space for learning that is mandated to focus firmly on serving public needs. As the 'local gateway to knowledge' public libraries provide 'a basic condition for lifelong learning, independent decision-making and cultural development' [30]. This affords them a unique position of trust and influence within the community, particularly when serving the often-complex digital literacy needs of their users. Indeed, the UK Government's present Digital Strategy posits public libraries as the key providers of digital access, training and support for local communities [31], in essence therefore placing them at the centre of digital literacy strategy and provision throughout the country.

Whilst current public library policy in Scotland likewise has no specific over-arching strategy for the development of intersectional digital literacy competencies in older adults, the very centrality, accessibility and high-level of user trust and support libraries enjoy mean that they are ideally situated and orientated to address this deficit. If 'the promotion of literacy is a *raison d'etre* of public libraries' [28, p. 383] then this contemporary lack of a targeted, specific and holistic digital provision for an older adult cohort only presents opportunities for new approaches and methodologies to be developed. As 'leaders in community digital skills training' [32, p. 1396] public libraries can be the vehicle to progress and implement new user-led participatory and peer-supported approaches to digital literacy competencies from both within and beyond their current user base. By their very egalitarian nature public libraries have the means to devise and incorporate new ways of 'doing digital' into a wider social inclusion agenda too, particularly as 'digital marginalisation is often bound up with other forms of social, economic, geographic and educational marginalisation' [10, p. 4]. This in turn fits very neatly against the compound sociological challenges faced by older adults, in that as a civic body public libraries can be responsive to the social, economic and age-related challenges they face in holistic, inclusive and trusted ways [10, p. 11]. Public libraries provide neutral, specialised and accessible places for learning, and these characteristics give them essential agency in programmes to develop more effective and sustainable digital literacy skillsets. Indeed, nascent ideas of user-led approaches to developing digital literacies in older adults arguably find their natural home in the public library arena too, as McShane (2011) succinctly states that:

'By locating experiments in user-generated content and participatory culture within the conceptual sphere of literacy, we can…recognise the distinctive role and potential of libraries within this area' [28, p. 393].

5   Research Focus and Questions

Based on these contextual foundations, this doctoral project will therefore centre on the following research focuses of study:

- That a lack of specific and intersectional digital literacy provision aimed at older adults in Scotland must be addressed to combat growing inequalities;
- That by engaging directly with older adults in participatory and peer-supported approaches will their compound digital literacy needs be addressed sustainably;
- That public library services are best placed to develop these new approaches to quality transferable digital literacy skills in older adults.

Building on these the project will specifically address the following research questions:

RQ1. How do older adults determine their own digital literacy needs and what factors influence these?
RQ2. How would older adults themselves address these needs?
RQ3. What is the impact of participatory and peer-supported methodologies on developing appropriate responses to these needs?

6   Methodological and Theoretical Approach

This doctoral project will engage directly with already established and accessible library groups, comprising older adult memberships, as well as seeking to engage with as wide a range of 'new' & relevant voices as possible. The present author is already conversant with several such groups and has regular access to and engagement with them.

Using the guiding principles of Participatory Action Research, that 'it involves researchers and participants working together to understand a problematic situation and change it for the better' [33], the project will employ this approach examine the principles of the CILIP Information Literacy model (2018) and assess in particular the five contextual areas of impact this framework posits:

- Information Literacy and Everyday Life;
- Information Literacy and Citizenship;
- Information Literacy and Education;
- Information Literacy and the Workplace;
- Information Literacy and Health [34, p. 4–5].

It will do so by designing an iterative process of structured workshop engagement and outcome-focused development with an established older adult participant cohort. This engagement will be longitudinal in process and outlook in order to make effective ongoing assessments of any interventions that are developed as well as providing a distinct contribution to knowledge in this critical field.

It is proposed that this engagement be based around the following aspects:

- An initial series of 3–4 pilot workshop sessions over a defined period with a small indicative group of participants. This will establish baseline practice and will support development of full cohort participation measures. **This activity will initially assess RQ1 as outlined;**

- A structured series of wider group engagement activity focusing on progressing the knowledge learned in the pilot measures. This engagement will potentially take place in 4–6 weekly/bi-weekly sessions over a period of around two months. It is planned that there will cumulatively be three such iterations over the course of approximately a one-year period. Practical, ongoing and peer-supported assessment of the outputs developed in this engagement will be included as an essential part of this process. **This activity will assess RQ1 and RQ2;**
- A summative workshop programme will determine the longitudinal impact of the research process and will present established findings and outcomes. It is anticipated that a formative skills toolkit will form part of these outcomes, but on the basis of utilising PAR frameworks during this research this is only one of many possible outcomes. **This activity will address RQ3.**

This methodology will thus also assess aspects of all five contextual areas of impact within the CILIP Information Literacy model, although it is anticipated that through this outlined research design particular attention will be paid to the impact of information literacy on everyday life, citizenship, education and health.

7   Conclusions

The older adult demographic in both Scotland and the UK is disproportionately affected by continuing deficits in digital literacy competencies. As much of everyday life and its associated tasks now take place via digital means and discourses, so too the real-world inequalities caused by these deficits continue to widen and to negatively impact an older adult cohort. Current civic and governmental policies do not target or tackle this specific issue in intersectional or holistic ways, and a present focus on individualist learning strategies similarly does not address the unique and compound needs experienced by older adults in relation to developing effective digital literacy skillsets.

Using public libraries as both a lens for understanding these issues and as a vehicle for challenging them, this project will thus seek to harness user-led, participatory and peer-supported approaches to developing ongoing digital literacy formation in an older adult population. It will work with and for older adults to design specific methodological processes which will meaningfully enhance their digital experience and literacy skills. The outputs developed will conceptually originate from within a public library sphere but will be transferable, scalable and consistently applicable across multiple environments.

A longitudinal research approach will ensure these outputs are given time to be assessed and refined 'within the field', thus in turn providing both effective interventions for developing digital literacies and the scope to assess these against existing information literacy frameworks. Such assessment will be helpful in determining the ongoing suitability of these outputs and will place them within accepted high-level standards. In this way the outputs of this research will be stress-tested variously in their developmental stage, in their theoretical contribution and in their ongoing practical impact.

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Maturity Model as the Tool
for Information/Data Literacy Assessment

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Abstract. The aim of this article is to present the similarities between two assessment tools: data literacy (DL) rubrics and research data management services maturity models (RDMS MM). In addition to their structural similarity (both tools are presented in matrix form), they also share a functional similarity in that both include issues related to the users of research data. A content analysis was performed on six RDMS MMs (found in literature) to search for matrix elements to evaluate DL-related problems. The results of the analysis were used to conduct two studies. First, the ratio of RDMS MM dimensions related to DL problems was compared to other dimensions. Secondly, the level of compliance of the MM with the DL competency matrix was determined. In both cases, the results showed a large proportion of DL issues in RDMS MM.

Keywords: Maturity models · data literacy assessment · information system maturity · rubrics

1 Introduction

New information technologies enable the collection and sharing of not only scientific publications (articles) but also the research data upon which they are based. With the capabilities of processing vast amounts of data (big data), the scientific research paradigm (data science) is changing, necessitating new skills from scientists known as data literacy [1, 2].

Data literacy, defined as the ability to use data for knowledge development, their coherent production, and critical thinking [3, p. 122], comprises a set of skills that are increasingly important for both science, businesses, and citizens alike. Indeed, the amount of currently recorded data available for scientific processing exceeds anything previously available to human civilization [4].

Despite the rapid development of data science, DL competencies have not kept pace. There is still a lack of common understanding of the term data literacy and the benefits it can bring [5]. Although DL in science is at a relatively high level, there remains a gap between the potential of DL and its actual use in science, in accordance with accepted principles such as FAIR, which include: findable, accessible, interoperable, and reusable data [6]. This article thus addresses the possibility of improving DL activities in this area.

Efforts to improve this situation, spearheaded by funders and national governments in the area of open access to data and data management plans (DMP) requirements, have resulted in discussions on research data services and research data management (RDM) [7, 8]. DL should encourage researchers to exchange their data with others, as willingness to disseminate data results and share analyzed (processed) data does not necessarily entail sharing the original research data [9].

According to Cox et al. [10], the participation of academic libraries in RDM processes causes fundamental changes in their role in relation to users. These trends have the potential to change the way research is conducted and the involvement of libraries in the process. Maturity models (MM) are a natural tool for describing these trends and changes. They are used in many areas to map the evolutionary growth stages of formalization, control, and measurement of the activity area [11], allowing organizations to benchmark their functions. MMs enable the description of data handling and conversion skills levels, which can be transferred to recipients with different levels of experience and competence [12].

The aim of the paper is to present the similarities between two assessment tools: DL rubrics and RDMS maturity models. Accordingly, the central research question of this study is:

- To what extent are data literacy issues described in maturity models for the assessment of research data management processes (RDMS MM)?

2   Data Literacy Rubrics and Maturity Assessment Models

2.1   Data Literacy (DL) Rubrics

Oakland [13, p. 234] identifies three methods for evaluating information/data literacy: fixed-choice tests, performance assessments, and rubrics. Each method is based on its own theoretical and educational assumptions, and each has its own opportunities and risks. Due to the research presented in the article, rubrics are of particular interest, even though they are relatively underused by librarians.

Rubrics are descriptive scoring schemes that allow for consistent assessment of progress in users' education, as well as for the analysis of their work and activities. The primary task of rubrics is to facilitate the assessment of the quality of various objects and activities [14]. When creating rubrics, it is important to define criteria for evaluating activities, ways of achieving success, levels of activity quality, reasonable, reliable, and fair ways of determining scores, and rules for describing and distinguishing successive quality levels [15]. Rubrics are therefore used to assess the quality of task performance in a wide range of subjects.

In libraries, rubrics can be used to research and evaluate many library products and services [16]. They can provide useful data on information-seeking behavior, user services, marketing and improvement activities, the usefulness of collections, and the effectiveness of information services. Rubrics are presented in the form of a matrix, where rows contain evaluation criteria and columns contain levels (successive steps) of DL, from the lowest to the highest. Criteria are essential tasks or indicators that demonstrate the proper functioning of data services. The other essential component of rubrics is performance descriptors, which indicate what is necessary for each assessment criterion to obtain an appropriate assessment [17].

2.2 Maturity Models (MM)

The term "maturity" is used to denote interest in the evolution of a studied phenomenon from its initial to its most advanced stage [18]. Maturity is sometimes interpreted as a state of completeness; however, this state is not final but rather a process of evolutionary progress towards achieving the designated goal [19]. It is sometimes defined as a series of successive levels that together form the expected or desired logical path leading from the initial state to the final state of maturity [20]. Maturity assessment is one of the conventional ways to determine the complexity of a system, service, or process [21], and maturity models (MMs) are used for this purpose. MMs are tools that support the assessment of the current and future states of a selected process, person, or group. They contain the most important elements of process efficiency in one or more areas of interest and describe the path of their evolutionary progress [22].

In their structure, MMs are very similar to the rubrics described in the previous part of the paper. They are usually presented in the form of a matrix, where the rows describe the dimensions of the maturity assessment, and the columns describe its levels. The levels define the stages of evolution of the assessed phenomenon. The intersection of dimensions with levels usually provides descriptions of areas for improvement that connect the domain to the levels. Additionally, depending on the model's purpose and scope, evaluation and scoring techniques, or suggestions for improvement may be provided. The assessment and scoring methods are an algorithm that facilitates the use of the model to ensure the consistency of the assessment and a common standard for measurement. Scoring methods may include weighting so that significant attributes are scored higher than less important ones [23].

The structures of the MM created in this way present a path for the development of the organization and the process. MMs are used as a benchmark tool in an organization to determine its current position and opportunities in the development process, as well as further improvement directions. The models describe maturity levels, typically ranging from zero to five, where level zero represents a lack of maturity, an initial state, and level five represents a fully mature system, process, or organization.

2.3 Comparison of Rubrics and Maturity Models

The information presented on DL rubrics and MMs suggests that the two tools are very similar. In fact, it could be argued that rubrics are a type of MM that focuses on a specific entity: the user of information, who often requires training in DL. The maturity of the user training system, the methods and processes used, and, most importantly, the training effects are usually assessed.

The similarities between these two tools primarily relate to their structure. Both are organized as matrices, with rows describing maturity levels or levels of understanding, and columns containing dimensions or objective indicators. The matrix includes a set of benchmarks that define the DL or maturity of the subject of the MM. Rubrics refer to a part of the MM that describes the organization at each maturity level for a given assessment area [11]. Therefore, rubrics can be considered a part of every MM.

DL rubrics are based on grading rubrics, which contain grading scales and attributes (skill levels) for each point on the grading scale. They are used for specific purposes, such

as evaluating the effects of training users in the field of DL, and indirectly evaluating training methods and the competence of trainers. By using rubrics in the assessment process, it is possible to determine the maturity level of both students and their training system. On the other hand, MMs can be applied to every aspect of human activity, from the general to the most detailed scale of phenomena.

3 Data Literacy Issues in RDMS Maturity Models

3.1 Research Data Management Services (RDMS)

Several models have been proposed in the area of information management for research data management (RDM) and data services (RDS), collectively referred to as RDMS. These models are used to assess the maturity of projects or parts of projects in order to achieve better data management and reuse. Part of this work deals with the involvement of libraries in these research data processes. In the initial stages of RDMS implementation in libraries, changes seem to be of little importance, as activities are adapted to the existing library structure and processes. However, with the increasing maturity of RDMS, they may lead to fundamental changes in the perception of the role of the academic library [10].

While laying the groundwork, the library focuses on running services that do not require significant new resources and experience, so staff workload can be relatively light. These activities are supported by university authorities' ordinances and carried out at the individual request of users, without the need to start cooperation between university units. Agreement (consensus) on all data-related expenses is necessary, as they are incurred at the expense of other forms of activity.

At a higher level, the library is involved in strategic efforts to coordinate its activities with institutional goals and mission. Management and staff are less focused on responding to individual information needs and more focused on planning for the future and the role of data services in shaping it. RDS are customized to meet institution-specific needs; they are based on the assessment of users' needs and cooperation between university units. The professional development of employees becomes part of the library's strategic activities, and expenses are more planned, which better supports the organization's further development.

At the highest level, services become more differentiated and correlated with the scientific research cycle. The library not only supports users and other stakeholders and recognizes their needs, but also creates an effective feedback system. The library also produces sets of detailed policies and strategic documents and ensures formal partnerships with internal and external units. The organization and structure of staff for research data services are changing from delegating individual librarians to dedicated teams, either cross-functional or specialized.

3.2 User's Place and His/Her Data Literacy in Selected RDMS MM

In pursuit of an answer to the research question presented in the Introduction, we decided to analyze the content of RDMS MMs available in the literature. The RDMS MMs

described in Table 1 were found and used for the study, taking into account the dimensions (key areas) considered by the authors of the models and how they were defined. The goal of this analysis was to identify the dimensions that are relevant to DL issues. The data collected in Table 1 are research data that will be processed in subsequent stages of the research.

Table 1. RDMS maturity models characteristics.

Maturity model	Dimensions (key areas)	Definitions
Qin et al. 2014 [24]	Data management in general	High-quality RDM process, user needs, plans, training, resources, workflow management
	Data acquisition, processing and quality assurance	Data quality and documentation, file formats, quality control, workflow, data measurement, analysis, verification
	Data description and representation	Metadata standards, metadata descriptions, metadata development, workflow
	Data dissemination	Data sharing or confidentiality, technologies for data sharing, data discovery, citation, data accessibility, security
	Repository services and preservation	Data preservation, curation and backups, security, version control, migration, storage
Peng et al. 2015 [25] (digital environment datasets)	Preservability	Data evaluation, acquisition, archive, governance. Assessing practices associated with data storage (Backup, duplicate)
	Accessibility	Data search & discovery, availability, accessibility, usability. Whether users can easily find and access data online
	Usability	Data format, visualization. User guide, interoperability. How easily users are able to use data and learn if data is suitable for their needs

(*continued*)

Table 1. (*continued*)

Maturity model	Dimensions (key areas)	Definitions
	Production sustainability	Product maintenance, update, improvement, reprocessing. Commitment and requirements of the product
	Data quality assurance	Data quality assurance, assessment, monitoring. Set of activities or procedures focused on defect prevention
	Data quality control/monitoring	Set of activities taken to evaluate the product to ensure that it confirms to the required specifications
	Transparency/traceability	Data provenance, reference and citation. Availability of information on data provenance and data processing system
	Data integrity	Information security, data integrity. Accuracy and consistency of data over its entire lifecycle
Kouper 2017 [21]	Leadership	Vision, strategy, culture, mission consistent with the institutional mission
	Services	Services match user needs, DMP, consultations, instruction, repositories, metadata, storage, data sharing, data curation, data citation
	Users and stakeholders	Needs assessment, evaluated, services adjusted to needs
	Research life cycle support	Support researchers, DMP, data deposit
	Governance	Data policies
	Cost and budgeting	Spendings, budgeting
	Cross-unit collaboration	Join initiatives, formal partnership, support from univ. Administration

(*continued*)

Table 1. (*continued*)

Maturity model	Dimensions (key areas)	Definitions
	Human capital	Staff, librarians, trainings
Cox 2017, 2019 [10, 26]	Policy and governance	Policy for RDM
	Services	Advisory/Technical (repositories), data analysis, visualization
	Staff skills	Translated skills, retraining, new skills
Fry et al. 2021 [27] (MAMIC)	Institutional policies and processes	Development and maintenance of policies related to RDM, and relevant processes that are related to supporting RDM services
	IT Infrastructure	Covers the breadth of an institution's RDM infrastructure. It includes infrastructure provision, file storage, synchronization, and authentication and access
	Support Services	Support and advisory services around training and consultation for RDM, DMP, and data curation. It includes in-person and online advice for researchers needing support in different areas of RDM
	Financial Support	RDM business plan, capacity and sustainability. It lists considerations that will secure the sustainability of RDM services
DMM Rubric (2020) [28]	Human capacity	Institutional knowledge, governance will and participation, training of external stakeholders regarding data processes, training of internal stakeholders, leadership buy-in
	Organizational capacity	Culture, communications, stakeholders, transparency

(*continued*)

Table 1. (*continued*)

Maturity model	Dimensions (key areas)	Definitions
	Structural capacity	Policies and procedures, collections, data system integration, data standards, research agenda
	Material capacity	Documentation, metadata, staffing, reporting, infrastructure, alignment

3.3 Methods

The research consists of two complementary parts. In the first part of the study, the dimensions of MMs presented in Table 1 were divided into four groups to facilitate the assessment of their nature and to eliminate possible doubts related to the varied nomenclature used by the authors of RDMS MMs. The division of dimensions [29] was adopted as follows:

- System characteristics: technical features of the RDMS;
- Social influence: RDMS management, leadership, policies and collaboration at different levels;
- Facilitating conditions: human resources, finance, support services;
- Individual user characteristics: RDMS user problems.

In the second part of the research, the description of RDMS MMs presented in Table 1, supplemented with elements from publications related to them, was compared with the DL competencies matrix described in [30], the most widely used study on DL. Ridsdale et al. presented articles on DL and related topics, thus presenting different perspectives on this issue. They proposed five knowledge areas containing 23 competencies (see Fig. 1) and 64 DL tasks/skills. These are organized hierarchically in relation to the top-level elements (data, collect, manage, evaluate, apply) and categorized as conceptual competencies, core competencies, and advanced competencies. For example, within the key knowledge area "Data collection", there are competencies such as "Data discovery and collection" and "Evaluating and ensuring the quality of data and source", while within the former competency, the following tasks were identified: "Conducts data exploration", "Identifies useful data", and "Collects data".

Based on the DL competency matrix, a competency profile for RDMS users was created, which served as a template for comparing it with the content of the RDMS MMs (Table 1). A text profile was created for each of the six RDMS MMs to describe the content of the model. The profile included expressions used by the authors of the MMs. In this way, seven text files were obtained: one for the DL competency matrix and six for the MMs. These files were relatively small; the model file contained 1613 characters without spaces, while the MMs ranged from 1847 to 659 characters, with an average of 1132 characters.
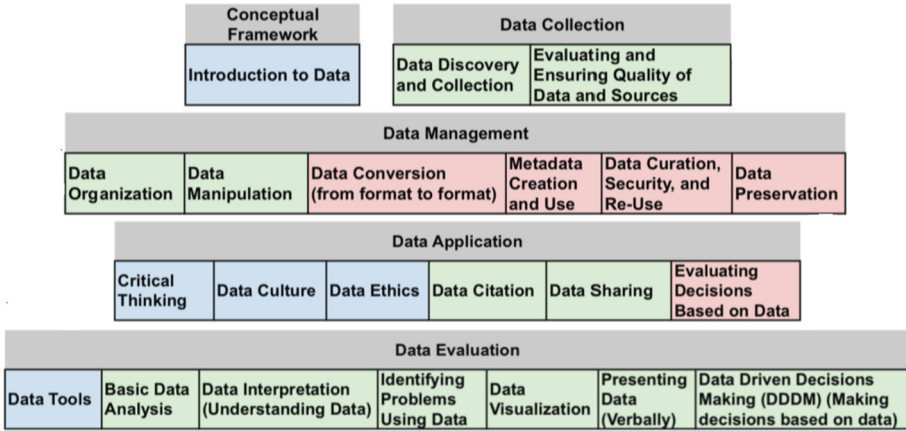
Fig. 1. Data literacy competencies (two upper levels) (Source: [30], p. 3])

3.4 Results

In the first part of the research, the following categorization of MMs into four groups was obtained, characterizing the content orientation of these models. The results are shown in the graph below (Fig. 2). The majority of elements in MMs concern technical issues, described by 12 different dimensions (35.2%). However, it should be noted that almost the same amount of attention is devoted to social influence, with 11 dimensions (32.3%) such as data management, data quality assurance and control/monitoring, leadership, governance, collaboration, policy, and structural capacity. Organizational issues come in third with 8 dimensions (23.5%), and individual user-related dimensions follow with 3 dimensions (8.8%) covering usability, users and stakeholders, and human capacity.

Fig. 2. Types of dimensions of maturity models

In the second part of the research, one of the AI-based ToolsAday tools was used to compare the semantic content of the model competency with the content of MMs. ToolsAday was created to support work with text, facilitating paraphrasing, supporting the creation of stories (story generator), and generating content for social media and email. One of the functions of the system is the semantic comparison of texts. The tool allows users to evaluate two texts and determine the p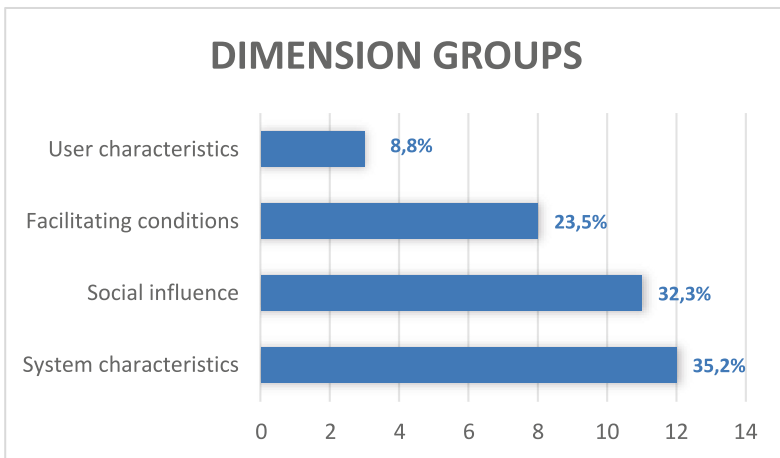ercentage of similarity between them, indicating similar and dissimilar elements. The analyzed texts showed a high degree of similarity, on average 53.9% (Fig. 3). The model of Qin et al. showed the greatest similarity to the pattern at 63.4%, while the DMM model showed the smallest similarity at 42.5%. In general, it can be concluded that the examined RDMS MMs show approximately 50% similarity to the DL competency model.
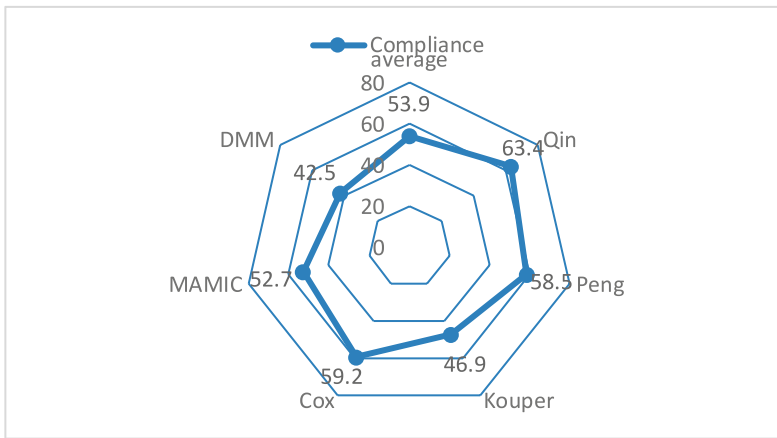
Fig. 3. Level of compliance of maturity models with the data literacy competency matrix

3.5 Discussion

The study assumed that the problems faced by data users, particularly those related to their DL, are reflected in RDMS MM. The study aimed to present the extent to which DL problems have been considered in RDM services that have been developed since the beginning of the second decade of the 21st century [31]. This objective was achieved in two complementary ways. First, the RDMS MM dimensions were generalized by unifying their nomenclature and scope. The procedure revealed that these MMs primarily focus on the technical features and functioning of information environments, with less attention paid to the individual needs of users of these services.

It follows that the creators of RDMS MM should pay more attention to the needs and place of information user in these services. Technical issues, although important, should be more subordinated to information needs, and RDMS MM designers should start their work by examining these needs.

Secondly, the content of RDMS MMs found in literature was analyzed and automatically compared with the DL competency standard [30]. The presented results demonstrate that DL competencies occupy an important place in the RDMS MMs, with about half of the content of these models related to these issues. Undoubtedly, the choice of the Ridsdale et al. [30] DL competency model also contributed to this, as it addresses this issue holistically, taking into account the processes of data collection, management, use, and evaluation.

The results may have been influenced by the variety of terminology used by the developers of the rubrics for assessing DL and authors of RDMS MMs. It may be surprising that similar criteria are used to assess the DL of users and the maturity of research data services (and thus, in a way, the competence of RDMS developers), although they are named differently.

4   Conclusions

RDM services are becoming increasingly common in the academic world, and as a result, issues related to RDM and services dedicated to it are becoming a frequent topic of research. One such issue is the role of users, their digital literacy, and its place in the assessment of these services. The presented results should encourage RDMS developers to include DL issues in the structures of supporting systems and librarians to incorporate DL skills in their services, as well as to prepare DL training for researchers and students.

RDMS developers should take into account the level of DL of users of these services at each maturity level, as it determines their ability to use RDMS. This should also be reflected in emerging MMs. This is one of the most critical factors in developing beliefs, attitudes, intentions, and acceptance of RDMS, which ultimately facilitates their recurring use. The maturity of RDMS is not only about their extensive functionality and technological innovation but also about ensuring that users can use these tools effectively. The rubrics used in DL assessment should be included in the construction of the MM for RDMS because they contain agreed values and descriptive, yet easily digestible data.

The research presented in the article is a part of a broader study on research data carried out by the author of the article and his team. Their effect is, among others, an article on maturity of research data services [32]. Further research in this area is planned, including the use of big data techniques in the evaluation of data maturity and data literacy problems in RDMS.

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Information Experience
and Information Behaviour

"My Personal Doctor Will not Be Replaced with Any Robot Service!": Older Adults' Experiences with Personal Health Information and eHealth Services

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Abstract. The ways of preservations of personal health and medical information vary, from digital to paper-based approaches. This study examines older people's experiences on eHealth services, including benefits. A postal survey was mailed to a random population sample of 1,500 individuals aged 55–70. A total of 373 (25%) responses were received. The mean age was 63.2 (SD 4.7) years of which 225 (60.6%) were women. This study focuses on the open-ended questions on personal health information management and views of eHealth services. Data were analyzed using content analysis. Older adults' experiences and attitudes are divided. The best possible eHealth service would contain versatile health information and combine information from different healthcare sectors. It would be easy to use and up-to-date, but would also allow the possibility to contact a real human being, such as via video connection. The findings reflect capabilities needed for personal health information management, relating to health information literacy.

Keywords: eHealth · health information · information experience · older adults · personal information management

1 Introduction

With age, the importance and relevance of health information usually increases noticeably. The information is preserved and managed in professionally maintained medical records, but also privately by patients. The ways of preserving vary, from digital to paper-based, but increasingly, medical records, and health services overall have turned digital. Reasons for preserving health records relate to both maintaining health but also to monitoring illnesses. For instance, we might want to or need to track possible changes in our cholesterol levels or compare what a doctor has written in medical care summaries

of different appointments. We need to manage our own and, in several cases, our family's medical information. These tasks are part of personal health information management [1].

As we are witnessing the digital transformation of healthcare, access to digital health services is becoming an increasingly important determinant of health. eHealth services are often considered to promote patient empowerment by facilitating patient control and providing tools for self-management [2–4], which can support the shift away from the 'paternalistic' model of healthcare, where an expert makes decisions on behalf of a patient, towards a patient-centred, more transparent, approach [5]. However, not all favour digital services, especially among older adults. Negative views on digital health services can reflect attitudes towards digital technology [6] or appreciation of direct interaction with healthcare professionals, for example [7].

The topic of this study relates to personal health information management, digital exclusion, digital health equity, and emerging technologies. Our aim is to contribute to filling in the gap observed in a systematic review, indicating that in comparison to perceived usability and satisfaction, relatively little attention has been paid to examining people's experiences on eHealth services and their usefulness [8]. Furthermore, it has been stated that the knowledge of the elements playing a role in older adults' personal health information management is scattered and unclear [1]. For this study, the following research questions were set:

1) How do older adults currently store and manage their personal health information?
2) What kind of visions and perceptions do older adults have towards the future of eHealth services?

2   Previous Research

2.1   The Ageing Population and Health Information

In Finland, people are covered by a universal public health and social care system. The constitution states that public authorities shall guarantee everyone adequate social, health and medical services. Healthcare and social welfare services are mainly funded by general tax revenues. In addition, private healthcare and social welfare actors provide occupational healthcare and complementary private services for citizens. eHealth services that are in common use across the healthcare sector include electronic prescriptions, a national health data repository and online patient accessible health record MyKanta. In 2022, MyKanta had 3.5 million users. More detailed account of the Finnish healthcare system can be found in a report of Finnish Institute for Health and Welfare [9]. In spite of the efforts to improve the integration of eHealth services, there are still problems with siloed information and systems not communicating with each other.

Finland ranks among the five fastest ageing populations worldwide. While the share of individuals aged 60 years and older was still 20% in 2000, it had increased to almost 28% by 2020 [10]. Researchers expect it to further increase to almost 35% by 2050 [10]. According to a large population-based survey in 2022, of the Finnish older adults 73% of 55–64 years olds and 52% of 65–74 year olds used the internet several times a day. In the younger age group, 95% and in the older 78% owned a mobile phone with a touch screen [11]. According to the statistics, 76% of those belonging to the younger age group

and 65% of the older age group had at the time of the survey searched information from the internet on health, diseases, or nutrition during the past 3 months [11].

With age, the importance and relevance of health information can be considered to increase noticeably [12]. Older adults experience an increased need to manage their health information for example, due to greater number of chronic diseases and medical visits. The active use of information has been associated with healthy ageing [12–14]. Issues related to health and well-being form a major category in the information needs of older people [15].

2.2 Personal Health Information Management

Personal health information management is a process that involves creating, seeking, organising, and sharing personal health information to family, peers, and healthcare [16]. Active and coherent management has been linked to, for instance, patients' knowledge of their condition [17] and adherence to treatment [18].

The information management related focus of our study is on storing and maintaining information. A review by Kolotylo-Kulkarni, Seale and LeRouge [1] observed that, according to the analysed literature, older adults managed various types of personal health information using several kinds of strategies and tools. Personal health and medical information can be textual, numerical, and visual. It includes - clinical data such as lab results, patient generated data such as self-care logs, and general health and wellness data, such as online information on medication side effects or health education materials. Older adults also created information, for instance, by checking their weight as part of their morning routine [19]. According to the review by Kolotylo-Kulkarni et al. [1], strategies and tools for management included electronic approaches relating to computers and internet (for example, patient portals) and paper-based approaches such as printouts, calendars, or notepads. The handling of papers has been described using such words as tossing, filing, and piling. In many cases, a care booking was done "just in case" [20]. Some people rely on intangible objects such as their memory [20].

The consumer health information technologies, that help people to track and organise their health information within and outside of clinical settings, are not typically used by older people [20]. These technologies include, for instance, self-management monitoring systems and patient portals [20].

Patient-accessible services shape people's personal health information management behaviour by providing new opportunities [21]. For example, Turner et al. [20] found that older adults having a passive approach for managing health information described themselves doing little intentional seeking of health information. Especially people in good health did not necessarily think that there is any need to follow and keep track of health-related information. In turn, active information seekers tended to be more open to health portal use [20].

2.3 Older Adults and eHealth Services

Older age has been associated with perceptions of barriers to use of technology and readiness to use eHealth [6], as well as actual less use of patient portals or eHealth in general [22, 23]. Based on studies on medical records, the oldest of older adults were

the least likely to use digital records and the least prepared to manage clinical personal health information by using digital technologies (e.g., [21, 24]).

In general, the attitudes towards digital technology can be negative among the older adults [6]. Furthermore, people might be anxious or nervous to learn and face new technologies. According to a study on challenges experienced by vulnerable groups (including elderly) in digital health services during the COVID-19 pandemic, the lack of strong e-identification or suitable devices were found to prevent access to eHealth services [25]. Perceptions of one's own skills, often related to age, are one of the most mentioned reasons for use or nonuse. Technical literacy, or lack of skills to use technology, was the most common barrier to use of telehealth among older adults in the study by Kruse et al. [26]. Despite perceiving digital health information as useful, Swedish older adults were found to be hindered by difficulties experienced when using technology [27]. Lack of technology skills [28], aversions against computers [29], lack of interest [30], lack of desire to use technology [26], or even computer anxiety [31] can be barriers to use. In addition, not only digital, but also medical and administrative competencies are needed [32].

According to Price and colleagues [33], older adults preferred a system that makes information interpretable and usable and provides advice rather than merely provides a storage for information. Luo, Dozier, and Ikenberg [34] found that ease of understanding the contents of electronic patient health records was positively linked to use. According to Eriksson-Backa et al. [35] also the high level of perceived everyday health information literacy, that refers to information literacy competencies in health setting, is positively related to positive attitudes to digital health services. The results emphasise the importance of everyday health information literacy as an enabler of the acceptance of digital health services.

According to a study by Turner et al. [20], older adults found that actual benefits of eHealth services include easy access to information about health, a more direct communication with health providers, and the possibility to make appointments online. Electronic personal health records have been found to be used specially to check test results, and for renewal of prescriptions and secure messaging with healthcare staff [34]. In a Dutch study, reviewing the medical record and checking appointments were perceived to be beneficial, but there were some problems concerning the interaction, for example, unresponsiveness of physicians to messages of patients [36]. In the systematic review by Hirvonen et al. [8], the use of eHealth services was divided into health management, social uses, and management of personal health information. Managing health included activities such as managing one's health in general, setting goals, planning, and scheduling, tracking one's own symptoms or behaviour, obtaining reminders or recommendations, and getting help in decision-making [8].

2.4 Empowerment, Lack of Physical Presence and Emerging Technologies

Having online access to personal health records has been characterised as an important tool for empowerment [37]. Moreover, access to personal health records and information exchange between patients and medical professionals can result in patients getting more

involved in their own care [38] and self-management [39], better attendance to self-care and informed decision-making, and improved trust between patients and medical professionals [40].

However, previous research indicates that, according to older adults, digital services are not viewed as applicable to all situations nor can they replace face-to-face services. For example, contact with healthcare providers via digital services was considered less personal [25], and lack of physical presence may affect patient communication and the patient-provider relationship. Admittedly, in a face-to-face meeting health care provider's touch can nonverbally express empathy and compassion, for instance [41]. This highlights the importance of digital empathy and "webside manners" [41].

People can also be unaware of existing services and their value and benefits [25]. Even if older adults tend to have more concerns and problems in using digital health services than younger individuals (e.g., [22, 23, 27]), they often find digital health services useful when they are aware of them (e.g., [42]). Moreover, need for and lack of guidance and support is another major hindrance of use of eHealth [26, 32, 43–45]. Need of guidance and not having been referred to eHealth services also hindered the use of a national patient portal according to a study by Kainiemi et al. [43].

The emerging technologies and practices associated with their use increasingly affect our society. Novel solutions will also be visible in the care of the ageing population. Remote health care has been associated with ensuring availability and access to cost-efficient and sustainable healthcare, but it also provokes discussion on topics like the lack of human contact. Furthermore, the field of artificial intelligence (AI) has shown rapid growth in recent years. AI has been introduced as a technology with the potential to transform medical practices, also relating to eHealth services [46]. The COVID-19 pandemic further increased the demand for remote healthcare services [47] but also for advanced AI-based applications and intelligent robot systems [48]. Robotics relate more generally to larger changes in medicine and healthcare but in the future are expected to be present for instance, in nursing homes. The current developments in AI have helped to expand the potential of robotics and the visions include, for instance, care, hospital, and assistive robots. As a whole, while technologies have a lot of potential to improve the efficiency and effectiveness of healthcare and access to health information, it has become increasingly apparent that their effectiveness depends on to what extent they leverage their anticipated benefits and enable access to information rather than mere systems [27].

3 Methodology

To examine older adults' ways to manage health information and views on eHealth services, a postal survey was mailed in 2019 to a population of 1,500 individuals aged 55–70 years, obtained from the national Population Information System of Finland. The sampling criteria were that the participants should be aged 55 to 70 by the end of 2018, have a permanent address in Finland, and be registered as speakers of the national languages Finnish or Swedish. A total of 373 surveys (25%) were received. The mean age of the final study population was 63.2 (standard deviation 4.7).

The questionnaire included both closed and open-ended questions on health information management, use, and views of current and future eHealth services, health information seeking and health behaviour. Both users and nonusers of eHealth services were encouraged to answer. The present study focuses on two open-ended questions of the questionnaire. These focused on personal health information management and visions of the future eHealth services.

In total, 345 respondents responded to an open-ended question on how they manage and keep track of the information relating to their personal health in their everyday life. Furthermore, at the end of our questionnaire, we asked them to imagine: "If there would not be any limits in resources or available technologies when developing a digital health service, how would the best possible service look like and what functions would it have?" Of the respondents, 159 answered this question. Of them, nine answered briefly "I don't know", leaving 150 more elaborate responses. Because most of the responses were fairly short, the qualitative data were analysed by using simple data-driven content analysis by colour coding to form themes in Microsoft Word. The selected citations have been translated from Finnish to English.

Among the older adults 27.1% were 55 to 59 years old, 28.2% were 60 to 64 years old, 33,5% 65 to 69 years old and 11.1% were aged 70 or above. Most of the respondents were women (60.6%).

4   Findings

4.1   Storing and Maintaining Personal Health Information and Health Records

An important aspect of personal health information management is storing and preserving personal health information. According to several respondents, storing the information in paper format is still typical among older adults. Papers were stored in a box at home, notes were kept in a notebook, and some also mentioned keeping a diary related to their personal health: "Medical reports in paper format, I do not use these documents with a computer." Digital information was also printed for preservation: "I arrange the sent epicrisis to a paper folder. Research results etc. I print information from MyKanta."

Paper and digital storage can also complement each other, and can serve different purposes: "I store part of the older health information in paper folders. The prescriptions are in Kanta.fi [MyKanta], vaccination information can be found in the vaccination card. Prescriptions are renewed through MyKanta. I book doctor's appointments online. The latest medical information can be found from Kanta.fi." MyKanta was mentioned often and, in some cases, as the only response to the question of ways to manage personal health information. It plays a major role in managing records and information relating to personal health: "Both in paper and digital format, I always look what is written in Kanta, but the information is scarce."

Some respondents also pointed out that they use several digital services and platforms: "At home on paper and on my own computer, - occupational health's "Own health" pages, - medication in MyKanta database, - City's "Own treatment" database."

In their responses, older adults spoke about the reasons for storing personal health information and needs for checking the information. Preparing for doctor's appointments was a common reason for checking the information or taking the papers with them:

"When going to a doctor. When tests and procedures have been made during several years. Changes in medication. The medicine that has caused allergy symptoms." The stored information was also compared to new pieces of information: "Prescriptions and renewing them, before doctor's appointment, lab results, medical reports, when a new symptom occurs, comparing older lab results to new ones."

Older adults did not only store information from the healthcare providers, but some did keep a record of their own measurements: "I use MyKanta, some of the doctor's reports are in paper folders, blood pressure results are on paper (self-measured). I handle information when I visit the doctor." In addition, articles and stories in magazines were mentioned to be worth saving: "I store them in paper format and on my computer: my own measurements (blood pressure, weight etc.), doctor's appointments and prescriptions. I follow and store articles that relate to my own health."

Over time the living environment, used services, and information needs can change, and this has its impact on managing personal health information: "Sometimes I take papers with me to the doctor because I have lived in several places." Significantly, making sure that the information will be available in the future may require actions from the individual: "I transferred my occupational health information from Mehiläinen [private health provider] to the public health centre, because these health problems continue and reoccur now when I am retired."

Interestingly, several respondents did not see reasons for storing personal health information. It was argued: "I don't keep any track – the doctor will tell you about the possible outcomes of the lab test results." Overall, maintaining information was not necessarily seen as easy: "Not in any way. Some things are on paper, but they are always lost somewhere." "I don't really keep any information. I will just mark in the calendar the date when some medicines are out, so that I know to fetch more. The receipt is in digital format and kept at the pharmacy. They will renew it if needed." Also others pointed out that medicines were the most central health-related thing they are concerned about: "I mostly follow the number of medicines in the medicine cabinet." One respondent gave an almost philosophical mortality-related answer: "I follow up my health status to an extent that I see if I get up from the bed every morning. If I can't make it, I am dead. Thus, I do not follow my information, it follows me."

4.2   Imagining Future eHealth Services

The perceptions of eHealth services clearly differed between the respondents. Some of the respondents expressed their satisfaction with the available services and did not come up with any new ideas: "Difficult to say. I have not been using them much, but I have been satisfied with the services. I get to renew a prescription; I can book a time for an appointment to occupational healthcare. For me the system seems to be enough. Luckily, I am quite healthy and have not needed much." Also, the MyKanta service was appreciated: "I am satisfied with the MyKanta service, it is a great improvement compared to the time before it." On the other hand, some respondents articulated that they have no need for digital services: "Digital health services are not beneficial at all! PS. I am old school." Or they even manifested clear resistance against the progressive technological transformation:"My personal doctor or nurse will not be replaced with any robot service!".

The expressed worries included issues related to privacy and security, as expected: "The digital services are sufficient, but I would like to restrict the possibilities (of healthcare) of spreading the information / possibilities to read my information. For example, now, just checking information about my prescriptions tells too much about my diseases." Additionally, a very timely concern relating to strong identification was stated: "National personal digital strong identification should be implemented first! Now we are all dependent on bank identification."

Wishes and development ideas were brought forth. Some of them were more general, like: "Easy to use, understandable, safe." As well as, "clear, up to date, fixing mistakes should be easy and quick." Many respondents considered the fast and workable connection as important: "Direct contact to healthcare professionals is the best!" "Possibility to contact healthcare professionals anytime from home." The phone and video connections were also highlighted: "Digital remote access e.g., via video connection. All markings and examinations. The results to MyKanta. Installations of digital services are fine. Phone services are also fine." Video connection provides possibilities also for medical consultation: "Video connection with the doctor. For example, showing a suspicious mole could be easily done via a video." The ageing and its challenges were pointed out in the responses: "Service that still works at the time when I do not understand anything about computers anymore."

In the responses the continuity of the care-pathway and possibilities to influence were mentioned: "Same doctor taking charge (of the treatment) or possibility to change (the doctor) if needed!!! Customer oriented approach!!!" A customer oriented approach also included tailoring and personalization of the content provided: "Personalized instructions. If a person has some basic illness or weight problems, a digital service could offer instructions for eating, exercise, self-care etc. by considering all the person's diseases, age etc., and residence and availability of services."

The findability and the presentation of information were discussed: "All information in "the same place" and in an easily understandable format, plain language "easy-to-read" possibility." Moreover, this viewpoint included easy access and aspects relating to usability and understandability: "Front page needs to be clear, no need for unnecessary clicks. Language should be understandable; pages should be easy to access (easy registration). But I still don't think it is a good thing that everything is online. Meeting the doctor in person is the most important to me and that cannot take place online."

Other responses also highlighted the importance of human contact and face-to-face connection for the ageing population: "For the young and those in working age, the technology is suitable and makes the service faster. Pensioners want personal service. It is not meaningful that elderly people living alone also attempt to use computers alone. Human contacts are important for them."

The aspects of prevention of loneliness and mental health problems were articulated and seen as major reasons for retaining the possibility of meeting the healthcare professionals in person: "Why digitally? Personal meeting would prevent loneliness!" "The development of mental health and substance abuse services in the manner that digital services would also include phone and face-to-face interaction. Through this kind of interaction lonely people's feeling of security and of being valued would increase. For elderly, the features of digital services should be easy to use. It should be remembered

that older people are not interested in new things, like voice control of the services, but see the old ways as safe."

The aspects of AI and robotics did not come up as often as it might have been expected, but the reason for this could also be that these issues are not so much present in older adults lives (e.g., in media that they follow) as maybe for younger ones. The importance of human decision making was pointed out by one respondent: "The registered interpretations should always be based on the right conclusions done by a doctor/nurse = = > ability to listen!!" Moreover, only one respondent imagined positive opportunities with robotics: "Doctor robot, that would examine a person from head to toe in a flash and would tell what is wrong and what should be done."

5   Discussion and Conclusions

Older adults' ways to manage their personal health information including the extent to which they use digital health services are divided. Fears, trust, and motivation, as well as general everyday life information practices and routines, guide their experiences and behaviour with digital health services. Without any limits in resources or available technologies when developing a digital health service, according to the respondents of this study, the best possible service would contain versatile health information and combine information from different sectors of healthcare. It would be easy to use, clear and up-to-date, but would also allow for the possibility to contact a real human being, a healthcare professional, for instance, via video connection.

The findings of our study support the observations by Kolotylo-Kulkarni and colleagues [21] about the multiple types of personal health information being managed and the use of several kinds of strategies and tools. Among the Finnish older adults participating in this study, paper-based approaches were still popular and digital tools were mostly seen as complementary. Papers were stored in a box at home, notes were kept in a notebook, and some also mentioned keeping a diary related to their personal health. One respondent pointed out that he is "old school" and another that "older people are not interested in new things, for instance, voice control of the services, but see the old ways as safe." Also problems relating to paper-based approaches were mentioned by pointing out that the papers are "always lost".

In many cases, preservation was obviously done "just in case" or for being able to compare the results and information to the older ones. Many checked information before a doctor's appointment. This kind of preparation for interaction with healthcare professionals has been also observed in previous studies (e.g., [36, 49, 50]).

Intangible objects, such as trusting one's own memory was not explicitly mentioned, as in the study by Turner et al. [20], but some of the respondents appeared to trust that healthcare providers will take care of the information and tell them if something needs to be known. A medicine cabinet was mentioned as a tangible object that "reminds" when medicines are about to run out and the prescriptions need to be renewed. Some of the respondents also created information related to health. They followed and kept a record of, for example, their self-measured blood pressure or weight, as in the study by Michelson and colleagues [19]. Some also collected and saved articles or stories relating to health.

While, for many, eHealth services, including communication via video calls, enabled more convenient ways to manage personal health information, they were not viewed as replacements to all paper-based approaches or face-to-face services. Like in the study by Kaihilainen et al. [25], many of the older adults in this study highlighted the value of the physical presence of a health care professional and the need for personal contact. The aspects of prevention of loneliness and mental health problems were articulated and seen as major reasons for retaining the possibility of meeting the healthcare professionals in person. Moreover, it has been stated that lack of physical presence may affect patient communication and patient-provider relationship [41].

The topic of our study relates to digital equity. According to our findings, the services should be inclusive, in other words, people should have the opportunity to choose from digital or face-to-face services. Several older adults were not interested in their personal health information or in managing it. For them, digital services might lower the threshold for contacting healthcare providers and motivate managing personal health information. The actual benefits of eHealth services include easy access to information about health, a more direct communication with health providers, and the possibility to make appointments online [20]. A major implication of the present findings to systems design is to focus on helping users with tasks they find arduous and especially when new services are expected to act as substitutes, to be sensitive also to their less apparent, non-medical social and emotional affordances and functions. One of the critical topics for future inquiries is to develop a better understanding of how people manage their personal health information as a whole in relation to specific ehealth services. A comparison between younger and older adults' personal eHealth management would also be interesting.

The findings might also reflect capabilities needed for personal health information management relating to health information literacy. With hindsight, the aspects of AI and robotics did not come up as often as it might have been expected. Likewise, only one respondent visualised positive opportunities of robotics. Evaluation of AI technologies, as well as, communication and collaboration with AI, are competencies that are defined as AI literacy. In the future, also older adults will need these capabilities for feeling inclusive, secure and in control of their interactions with AI-enabled services. All things considered, the impact and possibilities of intelligent technologies should be investigated together with older adults.

Lastly, we want to highlight some issues relating to our study. The citations chosen to represent the answers were from broad number of participants. They were translated from Finnish to English by the authors. The research questions could have been phrased also differently. Asking people what they would like to have can be challenging and especially the second survey question could have been a more concrete and precise one. The survey was conducted before COVID-19 pandemic and it might have changed the eHealth management practices of older adults. Therefore it would be interesting to repeat the survey now, after the COVID-19 pandemic and compare the results.

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How Students Seek Information in the Context of Fitness and Physical Exercise

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Abstract. We often find ourselves overloaded with information. In this research, we build upon extant theory on information literacy, rich media, and information seeking in the context of students' fitness and physical exercise. This is important as the students' practices of fitness and physical exercise can lead to desirable outcomes such as health, or negative outcomes such as injury. With a qualitative approach we address "how students seek information in the context of fitness and physical exercise". Grounded upon eight interviews and in-situ observations at a Nordic University, our preliminary findings point out that even if students exhibit elevated levels of literacy in academic issues, they seek and evaluate the information pertaining to their fitness and physical exercise in a quite different way from their academic issues. As expected, students prefer rich media information in digital format, but it is striking how every student consumes information in a highly customized unique way.

Keywords: Information literacy · fitness · exercise · physical activity · physical fitness · students health · students wellbeing

1 Introduction

In the last decades, our society evolved from information scarcity to information abundance. For the many things that we need to do in everyday life, we often find ourselves overloaded with information on how to do many things. A visit to an Internet search engine (e.g., Google) or a visit to an online video library (e.g., YouTube) can often lead to multiple results on how to do the same thing. The problem of information seeking often turns into a filtering and evaluation problem. In the context of information abundance, Information Literacy becomes a very necessary competence so that individuals can filter information in everyday life [1]. This is important so that individuals' actions can lead to desirable outcomes. In this research, we build upon extant theory on information literacy [2], rich media [3] and information seeking in everyday life [4] in the context of students' fitness and physical exercise. This is important as student practices of fitness and physical exercise can lead to desirable outcomes such as health and well-being, or negative outcomes such as pain and injury. In a world where so much information is available in multiple formats, it matters to understand how students seek information for the practice of fitness and physical exercise.

2 Theoretical Background

2.1 Information Behaviour and Information Literacy

The terms information behavior and information literacy are ubiquitous in library and information science [5, 6]. While research on information behaviour was heavily influenced by early models developed by academics [e.g., 4, 7], research on information literacy was heavily influenced by organizations representing information professionals [see 8, 9]. The two terms are however closely related, as pointed out by Shenton and Hay-Gibson [5] "information behaviour of an individual who is effective and adheres to rigorous moral standards in the location and use of information will obviously exhibit a high level of information literacy".

Most of the research on information literacy was bound to the traditional library and education contexts [10]. Early scholarly attempts to theorize information literacy in other settings took the view of information literacy as practices in their social context [see 11] and introduced the constructs of information literacy landscapes that are constituted through (1) social, (2) epistemic/instrumental, and (3) physical corporeal information modalities which reflect a social site (aka information environment) [12, 13]. On the other hand, research on information behaviour is not so bound with the library and education context. For example, the influential model of Savolainen [4] concerned with everyday life information seeking. Along with the same lines, the work of Kari and Hartel [14] was concerned with information behaviour in higher things in life that "are pleasurable or profound phenomena, experiences, or activities that transcend the daily grind of working and studying".

2.2 Media Richness

As defined in the seminal work about information processing in organizations by Richard Daft and Robert Lengel, media richness (also known as information richness) is "the ability of information to change understanding within a time interval" [15]. Consequently, information richness affects information behaviour and the choice of communication media. Examples of communication media include e-mail, voice mail, SMS (Short Message Service), Streaming audio, TV, and Web-Based GUI (Graphical User Interface) among many others. Media richness theory conveys that all communication media vary in their ability to enable users to communicate and to change understanding [16]. Despite the popularity of the theory across disciplines, inconsistent results from empirical studies have been challenging the explanatory value of theory [3]. Furthermore, recent advancements in information and communication technology raised even more challenges towards the original concepts [3]. Still, actors in the information space face an increasing multitude of communication media and the media richness theory remains a go-to for explaining why one given media is chosen over another, and what media is more appropriate to each contextual setting. Given that students use many distinct types of media for information pertaining to fitness and physical exercise, the theory provides a good theoretical basis for this work.

2.3 Students' Fitness and Physical Exercise

Plenty of research exists on students' fitness and physical exercise from the elementary schools to Universities [17–19]. There were many attempts to measure students' fitness and physical exercise, many programme initiatives to promote students' fitness and physical exercise were reported and technologies advanced to support it, and many links between students' fitness and physical exercise and other variables and concepts were investigated across disciplines. However, the information behaviour aspect has been overlooked in this context. To the best of our knowledge, this is the first study concerning how university students seek information in the context of fitness and physical exercise.

In this direction, a recent Croatian study merits by exploring the information behaviour aspect in this context but among personal trainers [see 20], still the information behaviour aspect in the context of fitness and physical exercise remains unexplored among students in general and higher-education students in particular. Along with the same lines, the doctoral dissertation of Noora Hirvonen studied everyday health information literacy quantitatively using questionnaires and physiological measurements in the context of Finnish Defence Forces' call-ups [see 21–23]. While covering a large population of young males that conducted their military draft duties mostly at 18 years of age, when most did not join a high education institution yet, she was one of the first to investigate health information behavior and health information literacy in connection with objectively measured fitness tests. Her research efforts opened our curiosity further on how students seek information in the context of fitness in practice in everyday life.

3 Methodology

Given the lack of extant theory on how students seek information in the context of fitness and physical exercise, we opted for an exploratory qualitative approach as in [24, 25]. In the first stage, the researcher was just exercising by himself right at a local gym that is available to students and staff members of a Finnish university for a fee within the premises of the University. Later, the researcher was caught by the pervasive use of mobile devices (e.g., smartphones and tablets) within the premises and as an information studies researcher, he started observing how students seek and use information supporting their workouts. After many months, the researcher's interest in the topic grew and the study evolved from observation to collecting interviews. A total of 12 students were approached by the researcher that transparently shared his academic background, university position, university affiliation and personal research interests on the information seeking in the context of fitness and physical exercise.

A total of eight students agreed to an estimated 20 min long semi-structured interview guided by an exploratory questionnaire whose many questions were derived from literature on information literacy and information behaviour (see Table 2). In accordance with methodological notes on how to conduct semi-structured interviews [26–28]. The interviewees were recruited first via informal conversations [see 29] at the premises of (1) the university gym after the researcher noted that the students' workout was about to end, and (2) the ball sports room after organized basketball practice. Three out of eight interviews were interrupted on-site due to lack of time but were later conducted by phone to cover all the questionnaire.

The interviews were conducted over five months during winter and spring when Finns tend to exercise indoors. Interviews were recorded in audio format using a Zoom H4n pro handy recorder device with consent. The high quality of the audio will increase the performance of automatic transcribing software in future research efforts. While the transcription was not performed yet, by playing the audio multiple times to get familiar with the collected data, the researcher found recurring patterns [see 30] that are worthy already being reported – this besides the preliminary stage of this research.

As noted in Table 1, most of the students were studying towards a Master or Bachelor degree. All the interviewees conducted physical exercise regularly. Three out of eight practised Crossfit and three out of eight practised basketball. In most cases, their gym workouts supported the practice of sports outside of the gym. So, it was a sample of students that took their sports conditioning seriously.

Table 1. Demographics of interviewees

Fictitious name	Gender	Rank	Discipline	Main sports	Exercise frequency
Mr Apricot	Male	Master	Information Studies	Calisthenics & Basketball	4
Ms Barbie Pink	Female	Master	Chemistry	Crossfit	5
Mr Cadmium Red	Male	Bachelor	Chemistry	Basketball & Chess	3
Mr Dark Coral	Male	Bachelor	Information Systems	Weightlifting & Cricket	3
Mr Eucalyptus	Male	Bachelor	Marketing	Crossfit & Floorball	2
Mr Firebrick	Male	Master	Industrial Management	Crossfit	5
Ms Green Crayola	Female	Master	Organization Studies	Basketball & Football	3
Ms Harlequin Purple	Female	Bachelor	Philosophy	Volleyball & Cycling	2

Table 2. Questionnaire

N	Question	Theme
1	What do you study?	Background & demographics
2	How many times do you exercise a week?	Background & demographics
3	Do you play any sports?	Background & demographics
4	Do you have any training routines?	ELIS
5	How do you find information for better exercising and improving your sports performance?	IL, ELIS
6	Could you give an example of how information impacted your physical condition positively?	IL, ELIS
7	Could you give an example of how information impacted your physical condition negatively?	IL, ELIS
8	From who do you get relevant information for better exercising and improving your sports performance?	IL, ELIS
9	What are your main sources of information pertaining to fitness and physical exercise?	IL, ELIS, MRT
10	Do you consume information while performing physical exercise?	IL, ELIS, MRT
11	How do you evaluate the information related to fitness and physical exercise?	IL
12	Do you trust the fitness industry?	IL
13	Do you trust fitness professionals such as class instructors and personal trainers?	IL, MRT
14	Do you trust the content producers of fitness, physical exercise, and sport performance content on social media?	IL, MRT
15	Can you give an example of a book, a software application (aka app), a website, a podcast and a fitness influencer that guided your exercise routines?	IL, MRT
16	How many days a week do your exercise?	Background & demographics
17	In the winter, do you exercise mostly indoors or outdoors?	Background & demographics
18	In the summer, do you exercise mostly indoors or outdoors?	Background & demographics

Table 3. Students' information sources in the context of fitness and exercise.

Source	Curator	Medium	Frequency (0-8)
YouTube	Alphabet	Digital video	8
TikTok	ByteDance	Digital video	8
Instagram	Meta	Digital video	8
Classes	Many organizations	Face to face	8
App	Many organizations	Video + Animated drawings	8
Facebook	Meta	Digital video	6
Training pal	NA	Face to face	6
Own digital notes	NA	Digital text	6
Family and friends	NA	Face to face	5
Training plan	Many or indiv.	Digital document (pdf) or app	4
Internet website	Many	Internet site	4
Apparatus and its instructions	Many	Design, drawings and text	3
Own paper journal or note	NA	Paper	1
Personal trainer	Many	Face to face	1
Mailing list	Many	E-mail message	1
Paper book	Publisher	Paper	1
Paper magazine	Publisher	Paper	1

4 Preliminary Findings

During the observation phase (i.e., prior to conducting interviews) the researcher could observe the practice of different modalities such as calisthenics, basketball, weightlifting, stretching, and foam rolling. Most of the students would train alone and, less frequently, some students would train in groups of two or three. It was common for the practitioners of weightlifting to ask help from others to help in spotting (i.e. supporting another person during a particular exercise, with an emphasis on allowing the participant to lift or push more than they could safely do alone). There was a visible competition for equipment (i.e., squat rack, pull-up bar, plyo boxes for jumping and bench press) and also a visible competition for floor space where students would mostly warm-up often while looking and their smartphone.

The observation revealed that many of the students used smartphones and tablets for longer periods just before their gym workout. Furthermore, many used it during their gym workout as well. Many were consulting their training plans before their workout, others were following apps and video instructions that guided their workout. More interestingly, many consumed fitness and physical exercise information during the rest periods between sets. For example, many would check videos explaining the correct form of a given exercise. Some, even if contrary to the gym rules, would record their workouts using their smartphones or even smaller camera devices (e.g., DJI Osmo or GoPro Hero). It remains unknown if those self-recordings were used to check their own exercise form, share with a personal trainer, post on social media, or any other purpose.

After completing the observation period, the researcher conducted the interviews by following the previously prepared questionnaire (see Table 2). Here the results were consistent with the prior observation phase, but the interviews were much more revealing. First, we found that even if students exhibit elevated levels of literacy in academic issues, after all, they study at a high level in a country with a reputed education system, they seek and evaluate the information in the context of fitness and physical exercise in a quite different way from their study and academic context. As expected, and in consistence with rich media theory [see 3], students prefer rich media information in digital format (see Table 3), but it is striking how every student consumes information in a completely unique way – most of them consume very different content even if practising the same sports modality. This is explained by the high personalization, high interactivity, and high intrusiveness of the information providers' platforms.

Furthermore, it was remarkable how students emphasised the physical and corporeal modalities of information in this context [see 12, 13]. To see a person, either face-to-face or on video was highly valued by the students for the practice of exercise. Furthermore, and theoretically relevant to extant theory on information evaluation, many students evaluated the trustworthiness of the information by the physical looks of the individual information-provider (e.g., YouTube influencer, personal trainer, or other individuals). Many of the students (n = 5) pointed out that we should value the advice from an information provider with a "good-looking" body over a not so "good-looking" body. In this sense, being "good-looking" was a perceived indicator of the expertise and trustworthiness of the information provider. Or in the words of three interviewees, if they look in a certain way "they know what they are talking about".

As evidenced in Table 3, the main sources of information used by the students were video-sharing platforms and social media (e.g., YouTube, TikTok, Instagram and Facebook). Many of the students pointed out that they are often not actively seeking information on fitness or physical exercise. Instead, the algorithms of video-sharing platforms and social media "push" such content to them. Often students "like" the content pushed by a certain content provider, and then it is more likely that the algorithms will push content from the same "liked" content provider again and again. Students often chose to subscribe to a channel or a content creator, meaning they will be notified every time their "liked" content creator publishes a new video. Given the importance of the video content creator (aka influencer) in the context of fitness and physical exercise, it is not surprising that half of the interviewed students (n = 4) associated a big number of followers with the trustworthiness of the provided information. To sum up so far from the perspective of information seeking and information evaluation, the corporeal "looks" of a person and number of followers matter.

Students also showed signs of critically consuming content pushed by video-sharing platforms and social media. Many students (n = 3) avoided information perceived as exaggerated and unrealistic. In the words of some students "too good to be true" or "when they say guaranteed, I become skeptical". In addition, some students (n = 2) valued videos citing literature in sports science. Even if not following or understanding the cited sports science academic literature, the students valued content creators that systematically cited academic studies in their videos. Interestingly enough, the majority of the interviewed students are aware that many academic studies in sports science have

conflicting results (e.g., should you exercise with knees over toes? or should you foam roll your IT band? or should you jump with a bar loaded with height on your back?). All this evidences that the interviewed students not only exercised frequently but also consumed a lot of information in the context of fitness and physical exercise. Many looks for answers on the topic, but also learn enough to formulate questions themselves.

5   Preliminary Conclusions

The result that caught our greatest interest from our qualitative inquiry of how students seek information regarding fitness and physical exercise was the extent to which information is personalized to each individual. The affordances of digital artifacts (e.g., apps and video-sharing websites) allow prominent levels of interactivity, market segmentation, content personalization, and customization making students each of the students consume information in completely different ways. Even if students practice the same sports modalities, use the same gym equipment, and use the same video-sharing platforms (e.g., YouTube, Instagram, or TikTok) they consume quite different content. Their experience is vastly different from reading a magazine (e.g., Men's Health, WomenFitness, or Runner's World), reading a book, or attending an organized sports class with face-to-face instructions. They are exposed to very different content suggested by the algorithms of video-sharing websites and social media. Often without requesting or seeking certain content, they chose "to follow" or "not to follow" the content producers of different videos mostly freely available on the Internet. In the current digital world, even if two individuals are practicing the same sports modality, the odds are that they are consuming very different information regarding its practice (i.e., different content creators, different channels, different sites, different apps).

Our findings point out the very influential role of fitness influencers on video-sharing platforms and social media. The desirable outcomes such as health and well-being, or the negative outcomes such as pain and injury are influenced to a large extent by those fitness influencers that create media-rich and digital content distributed by video-sharing websites and social media. With so much influence, there must come a lot of responsibility as they provide information for the practice of fitness and physical exercise. On the one hand, they merit by motivating individuals to embrace positive changes in health via sports and physical exercise, but on the other hand, they can also provide information that is not backed by sports scientists, physical therapists, and nutritionists among other reference and high-educated professionals. While the information flowing towards students is embedded in complex multi-level social networks that aggregate personal trainers, fitness influencers, fitness brands, local gyms, journalists, video sharing platforms, books and magazine publishers, social media platforms, friends and family, training pals, nutrition specialists, nutrition brands, dieticians, among many other, the so-called fitness influencers have a very central role regarding the content of the messages that are passed to the consumers of information regarding fitness and physical exercise. The video sharing platforms and social media also have a central role, but not so much on the content. They are more interested in the monetization and viewership of their platform than in curating content toward more rigorous or evidence-based information.

So far, we focused our preliminary efforts on reporting on "how students seek information in the context of fitness and physical exercise", but our future research efforts

on "how students evaluate information in the context of fitness and physical exercise" seems to be of greater importance. Besides the high academic level of the subjects under investigation (i.e., studying towards Bachelor and Master studies in a country with a reputed education system), it is rather concerning that it seems that the format (i.e., rich media in digital) matters more than the content and its curation. As information pertaining to the topic flows in very complex multi-level social networks that aggregate a multitude of individuals, organizations, and technologies, figuring how individuals find, use, and evaluate fitness and physical exercise information will require engagement in cooperation with other disciplines (e.g., media studies, sports science, artificial intelligence). The phenomenon under investigation was revealed to be so complex that it requires cross-disciplinary joint "puzzle-solving" efforts.

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Changes in Older Adults' Attitudes and Use of Health Information and Communication Technology from 2019 to 2022

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Abstract. The aim of the study is to explore the adoption of a national health ICT system by people at the age of 56 years and older. Research questions were: (1) How do older adults use healthcare ICT to access information about their health history and about healthy lifestyle? (2) How do they evaluate their possibilities to adopt new ICT? A survey method was used, and changes in the period 2019 to 2022 were examined. The main findings are that a positive change was found in people's use of the system for communicating with health professionals and gaining information tailored to their own health. No increase was found in the use of it for obtaining information about various other health related issues. Furthermore, a positive change had happened from 2019 to 2022 regarding people's perceptions of their possibilities to adopt new health ICT.

Keywords: Health information · information technology · older adults

1 Introduction

It is crucial that people can gain reliable and relevant information about their health and about healthy behaviour. Health information is increasingly being disseminated digitally, which creates a requirement for people to adapt to an ever more complex information environment and take new technologies in use.

The Prague Declaration [1] describes the ability to make effective use of the information environment to enhance one's knowledge throughout life as a basic human right of lifelong learning. Hence, it is important that people have sufficient technological and informational skills to be able to use the digital information environment for their own good [2].

This study investigates older Icelanders´ adoption of healthcare information and communication technology (ICT) and how they perceive their possibilities to adopt new ICT.

2   Reference Review

Information and communication technology (ICT) has rapidly transformed the possibilities to produce, disseminate, and access information, a progress that can be expected to continue in the coming years. The use of ICT in healthcare services has received a growing attention in the last few decades. The importance of it for health information exchange between individuals and healthcare professionals was further revealed at the outbreak of COVID-19 in 2020 [3]. The use of ICT has the potential of bringing the healthcare system closer to people in various ways. This can include, for example, countering poor accessibility to it due to geographical isolation, or other difficulties that make it problematic for people, or even hinders them, in using the service on-site [4, 5]. It has, furthermore, been pointed out that by enabling enhanced digital information and communication exchange between individuals and healthcare professionals that is tailored to the needs of the individual, they can be empowered to become more involved in their healthcare. This can open up for relationships between them which are based more on partnership and mutual decision making, which in turn can improve the quality of the service [6]. Previous studies have reported about favourable use of health ICT for communication and support by healthcare professionals, which has promoted participation in self-care by the individuals [7]. Furthermore, there are reports about indications that the use of ICT in healthcare service can lead to improvements on national health outcomes [5].

Gu et al. [8] found that several factors can have positive effects on people's intentions to adopt health ICT, such as believing that using it will prove to be beneficial and valuable for them, that it will satisfy their needs, as well as being confident that they have the necessary support to take the technology in use.

Studies have found that older people do not adopt new ICT as quickly as younger people [9–11]. This has sometimes been explained by technology primarily being designed with the needs of younger people in mind, thus the needs of older people have not been taken sufficiently into account. Other factors that have been identified are for example that older people may doubt their capabilities of using ICT, and that they may need help when it comes to adopting new technologies [9]. It has also been suggested that when it comes to recognizing quality health information, they choose to receive assistance from health professionals [12].

However, although older adults´ lag behind younger people, their use of digital sources has grown considerably, including sources found on the internet, as well as mobile technology such as smartphones and tablet computers [9, 10, 13], and the same goes for the use of social media [14]. There are indications that there has been a shift in their attitudes and that they are ready to adopt new and emerging technology in healthcare [15].

Along with the development in technology and the increase of digital health information, people have been brought new potential for health management and to improve their health behaviour [16]. For this to happen it has been stressed that they need to be motivated [17] and that it is important that technology is designed with the user's needs in mind. It is necessary that older people find it uncomplicated to use the technology and that they have confidence in their ability to use new ICT [9, 17–21]. Otherwise, they may be inclined to avoid adopting it.

Thus, to explore the adoption of health ICT by older people in more detail it was decided to focus specifically on the changes in older Icelanders´ use of healthcare ICT and their perception of their possibilities to start to use new ICT in the period 2019 to 2022 will be examined.

In Iceland, an overwhelming majority of the population, or 95%, has been reported to connect to the Internet at least ones a week [22]. Thus, the possibilities for gathering digital health information may be deemed as being very good. However, it needs to be kept in mind that having Internet access is not enough as it may not be used to gain digital health information [23]. Therefore, other issues regarding the use of health technology must also be taken into account.

Still, access to health information has been increased. In 2009, a new legislation was enacted to ensure people the right to access their health records, although many of the files are not yet in digital form [24]. Furthermore, a multipurpose ICT system called 'Heilsuvera' has been made available. The system offers a wide range of information about diseases, health issues and healthy lifestyle, from health professionals. In addition, it is a communication system for health professionals and the users, where people can for example, book appointments with health professionals, renew drug prescriptions, examine their history of vaccinations, and send short questions and receive answers from physicians [25].

3   Aim and Research Questions

This study aims to explore older adults' adoption of healthcare ICT, as well as their perceptions of their potentialities to adopt new technologies. Changes in the period 2019 to 2022 will be studied.

The start of a retirement age is sometimes used to define "elderly" in Western countries [26]. Retirement age varies, however, between countries. For example, it begins at 58 years in Lithuania, while in Iceland people can retire at the age of 65 [27, 28]. Thus, defining older age by retirement age is rather arbitrary. Considering that there is no clearly defined age when people become older adults it was decided to examine people of the age of 56 years and older.

Two research questions were developed: 1) How do older adults use healthcare ICT to access information about their health history and about healthy lifestyle 2) How do they evaluate their possibilities to adopt new ICT?

The intention is to seek a better understanding of how older people can make effective use of the information environment and gain advantage from health ICT, and thus become better equipped to adopt healthier lifestyles. Increased knowledge about this issue can be useful to better understand how their needs for assistance at using ICT can be met and thereby strengthen the efficacy of digital health information provision. Hence, knowledge of factors that relate to older adults' media- and information literacy can have implications for health promotional activities and may be used to improve the outcome of health education.

4   Methods

Quantitative methods were chosen, and surveys were conducted in 2019 and 2022.

4.1   Data Collection

For each survey, the data were gathered from two random samples from the National Register of Persons in Iceland, using internet and telephone surveys. The surveys were conducted in January 2019 and in July 2022. In 2019 the total sample size was 1.800 people, 18 years and older. For the telephone survey, a random sample of 300 people aged 60 years and older was used, while for the internet survey a random sample of 1.500 people at the age of 18 to 59 years was used. In 2022 the total sample consisted of 1.200 people, 18 years and older. The telephone survey used a random sample of 300 people aged 60 years and older and for the internet survey a random sample of 900 people at the age of 18 to 59 years was used. Thus, the respondents came mainly from the telephone surveys. For the surveys each year, both datasets (internet and telephone surveys) were merged, allowing answers from all individuals belonging to each set of data. The total response rate was 39% in 2019 and in 2022 it was 45%.

The focus of the paper is only on people that are 56 years or older. In 2019 the number of participants in that age group was 173 and in 2022 it was 214.

4.2   Measurements and Data Analysis

The measurements for the part of the survey presented in this paper consist of four questions that were examined in 2019 and in 2022.

1. The use of health ICT was examined by two questions. A five-point response scale was used for both questions (Very often – Never):

a. The participants use of the healthcare ICT system in relation to their own health was examined by the question: How often or seldom have you used Heilsuveru in communication with doctors or to get information about your health (e.g. due to appointments, view prescriptions, or send a message to a family doctor).
b. The use of the system to seek information about various health issues was examined by the question: How often or rarely have you used Heilsuveru to get information about a healthy lifestyle, such as nutrition, exercise or other health issues?
2. The possibilities of taking new health ICT in use were examined by two questions which were in the form of statements. A five-point response scale was used for both statements (Strongly agree – Strongly disagree):
a. I find it difficult to begin to use new technology.
b. It is easy for me to get help at using technology when needed.

Because of the response rates, the data were weighed by gender, age, place of residence and education, so that it corresponded with the distribution in the population. Reference figures for age, gender and place of residence were obtained from the National Registry of Iceland and for level of education from Statistics Iceland. The raking method was used, with 5 as upper limit and 0.2 as lower limit. The analysis is descriptive and all analysis is based on weighed data. Survey results from 2019 and 2022 will be compared.

5   Results

Two questions were used to explore the use of the Icelandic health ICT system "Heil-suvera". The first questions asked how often or seldom the participants had used the Icelandic health ICT system "Heilsuvera" to communicate with health professionals to get information tailored to their own health. The second questions asked how often or seldom they used the system to seek information about health related issues. Figure 1 shows the results.
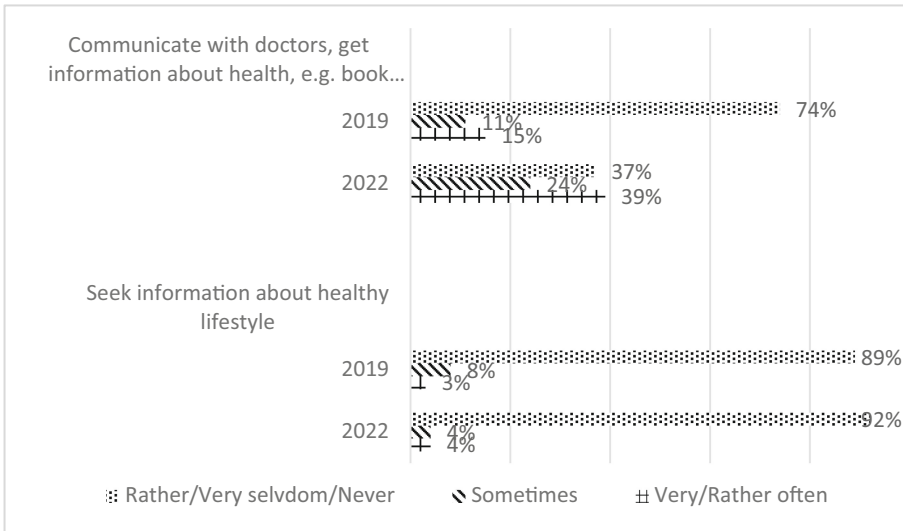

Fig. 1. Use of 'Heilsuvera' to communicate and to seek information about healthy lifestyles

As can be seen in Fig. 1, the use of the system to communicate with health profession-als has increased considerably in the period 2019 to 2022. The Percentage of participants who have done so rather or very often has more than doubled and the Percentage of those who have done so rather/very seldom or never has diminished by half.

The Percentages for the use of the system to seek information about heathy lifestyle, on the other hand, are almost identical in 2022 as in 2019. A slightly lower Percentage of participants had sought it rather or very often in 2022 compared with 2019, while the Percentage of those who have done so very/rather often or never is slightly higher. The results show that this part of the system is rarely being used (Fig. 1).

In addition, the participants were asked about how hard it had been for them to start using new health ICT in use, and about their possibilities of getting assistance at using technology, see Fig. 2.

Figure 2 shows that there are changes in how people perceived their possibilities of adopting health ICT. A lower Percentage of participants experienced difficulties at adopting new ICT in 2022 than in 2019. The Percentage of those who agree with the statement "I find it difficult to begin to use new ICT" has diminished and the Percentage of those who disagree with the statement has increased.
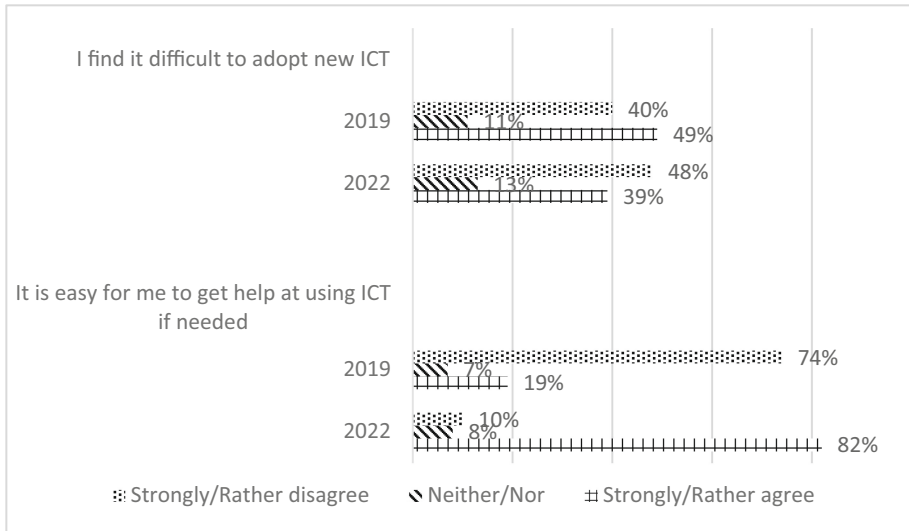
Fig. 2. Difficulties at taking new ICT in use – Access to help

In addition, there was a huge change in how people assessed their potential of getting assistance at using ICT. In 2019 the majority of participants disagreed with the statement "It is easy for me to get help at using ICT if needed". The results were, however, reverse in 2022, with an overwhelming majority of them agreeing that it is easy for them to get help (Fig. 2).

6   Discussion

As new technological possibilities for distributing and gathering information emerge there has been an increase in the provision of digital health information. To follow this development, people constantly need to require new knowledge and adapt to the changes in their information environment. The current study explored the adoption of healthcare ICT by Icelanders´ who are 56 years and older by comparing results on their use of health ICT and how they perceived their possibilities to start to use new ICT in the period 2019 to 2022.

Previous results from 2019 show that older people were in general motivated towards getting health information. In addition, they were also interested in getting digital health information and considered having full access to their electronic health records to be of significance [17]. Yet, they used the health ICT system 'Heilsuvera' very seldom. The majority of participants hardly ever used the system for communicating with health professionals, or for gaining information that was directly related to their own health. Furthermore, the system was used even more infrequently to seek information about healthy lifestyle or other health related information. In order to bring technology into general use it needs to be introduced so that people get familiar with it and become ready to get engaged with using it. The system had not been introduced very much in 2019

and in most of the health clinics in Iceland it had been in use for a relatively short time. Thus, it is perhaps not particularly surprising that the system was used so rarely.

In 2022, however, there was an important change in the use of the system. The Percentage of those who had used it often for communicating with health professionals had more than doubled, as it went from 15% in 2019 to 39 Percent in 2022, and the Percentage of those who used it seldom or never had decreased by half, from 74% in 2019 to 37% in 2022.

Healthcare ICT can be used to reduce difficulties related to access to the healthcare systems, especially when using the service on-site becomes problematic [4, 5]. When Covid-19 happened in 2020 more was done to promote the system and the pressure for people to use it increased. It was used to promote information about Covid-19, for example to book appointments for testing for Covid-19, for receiving test results, and to order certificates. And on the whole people were encouraged to use the system more, not only for information about Covid-19 but health information in general. So, more was done to introduce the system, which probably can explain, at least partly, the increase in use of it for communication with health professionals.

In addition to being able to get various information that is of relevance to their own health the system offers a wide range of high-quality information about healthy living and various other health related issues. The use of it to seek this information, however, had not increased and was even slightly lower in 2022 than it was in 2019. It has been suggested that belief in the beneficial and valuable aspects of ICT is a crucial factor for people to adopt it [8]. The trustworthiness of the information itself is essential as there are indications that people prefer health professionals to point them to where they can obtain reliable digital health information [12]. There is therefore every reason for health authorities to promote that part of the system better and place emphasis on motivating people to obtain information there.

An examination of the peoples' experiences at taking ICT in use showed that a positive change had happened from 2019 to 2022. The results from 2019 show that about half of the participants found it challenging to start to use new ICT. Furthermore, the majority (74%) maintained that when they needed assistance at using technology, they could not easily get it. This is of significance, as it can influence whether people are likely to put in the effort to adopt new technology. Prior studies have shown that it is of consequence for older people that technology is easy to use and that they believe that they have the ability to take new technology in use, as well as knowing that they can get assistance at it [9, 19, 20].

The results from 2022, however, paint a different picture. The results about how difficult the participant perceived it to be to begin to use new ICT had reversed when compared with 2019. The rate of those who claimed to have problems with it had gone down (39%) and the rate of those who did not had gone up (48%). There was, furthermore, an even greater change in how people assessed their possibilities of getting assistance at using ICT, with the great majority (82%) stated that it was easy to get help when they needed it. So, something happened during those years that changed the picture in a very positive way, that helped people to adopt new health ICT.

The outbreak of Covid-19 highlighted the importance of healthcare ICT for information exchange between individuals and healthcare professionals [3]. The period during

which Covid-19 was active began in the early year of 2020, that is, after the first data collection took place, and was still ongoing when data for the second survey was collected. It is not possible to assert that the conditions during Covid-19, when it became more important for people to use technology for health information, caused a positive change in older people's perception of their possibilities to adopt health ICT. Nevertheless, it can be assumed that the Covid-19 situation, together with the fact that people had had more time to get to know the new health system, were among the influencing factors.

The overall studies are limited by a total response rate of 39% in 2019 and 45% in 2022. In order to compensate for this and reduce the impact of non-response bias, the data were weighed by gender, age, place of residence and education, so that it corresponds with the distribution in the population. The findings may, therefore, offer valuable information about the changes in adoption of new ICT among older Icelanders´.

7   Conclusion

To explore how older people adopt new technology to gather health information, two research questions were developed. The first one asked how older adults use recently available ICT to access information about their health history and about healthy lifestyle? The second one asked how they evaluate their possibilities to adopt new ICT?

The aim was to get a better understanding of the advantages that older people can gain from ICT development and how they can use it to improve their capabilities to take up a healthier lifestyle. Increased knowledge of this may be of value when it comes to recognizing their needs for help at adopting health ICT and improve the possibilities of reaching them with digital health information.

By comparing results about the use of a new healthcare ICT system in 2019 and in 2022 a positive change was revealed in people's use of it for being in contact with health professionals and to gain digital information relevant to their own health. In 2019 the great majority of older adults had not yet adopted the system, while in 2022 the use of it had more than doubled. There was, however, no increase in the use of it for obtaining various high-quality information from health professionals regarding various health related issues that are not directly connected to their health history. For people to be able to make knowledgeable decisions about healthy living, it is essential that they can gather reliable information about these issues and that is what the system offers. Therefore, it is important that the health authorities make an effort to introduce this part of the system better.

Results about people's perceptions of their possibilities to adopt new healthcare ICT, furthermore, showed that an important change had happened from 2019 to 2022. In 2019 older adults did not find their options for adopting ICT to be good, Whereas, in 2022 this had reversed and that the majority of them considered their possibilities to be good. This was particularly the case regarding their options of having access to help in adopting technologies.

Therefore, it can be concluded that in order to provide older adults with digital information related to their health requires more than making new ICT systems available. For older people to be ready to accept and adopt new health technology, it needs to be introduced to them, and in addition they must be offered technical support and training to use it as needed.

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Approaches to Exploring the Information Worlds of Women Engineering Students

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Abstract. This paper explores the application of two theoretical approaches within Library and Information Science (LIS) literature, and critically reviews them for inclusion within a proposed PhD study. The two approaches are Women's Ways of Knowing, a model of women's epistemological development; and intersectional feminism, an inclusive and holistic approach to feminist research. The paper outlines both concepts, presents a critical literature review of their application in LIS research, and identifies their potential future use both within the proposed PhD study, and within LIS research more broadly.

Keywords: Information behaviour · Women's Ways of Knowing · undergraduate engineering · feminist research

1 Introduction

This paper explores topics arising from planned doctoral research into the information worlds [1] of female undergraduate engineering students. The research will use a phenomenological approach [2] to explore how female engineering students use information as part of their learning process, and how the gender balance of the engineering classroom affects the information behaviour of minoritized genders. The information worlds approach will be used to frame how women engineering students occupy multiple small worlds (as women, as learners, and as novice engineers), which may have conflicting social norms and information values.

This paper will present a critical review of the literature. It will focus on two theoretical approaches currently being explored: intersectional feminism [3, 4], and Women's Ways of Knowing (WWK) [5]. These concepts will be outlined, their application within Library and Information Science (LIS) literature reviewed, and gaps for further research identified.

Although the information behaviour of engineers has been extensively studied [6, 7], with some papers focusing on students in particular [8], the female perspective is under-researched. There is a lack of research on the impact of marginalised identities on information behaviour, including variables such as gender, race, and class [9]. Intersectional feminism and WWK both present opportunities to explore women's experiences in heavily masculinised environments such as the engineering classroom, and the impact

this may have on their information behaviour. This paper will suggest ways in which these theoretical frameworks could inform further research, both in the planned PhD research and within the wider LIS research field.

2 Women's Ways of Knowing

This section will outline the concept of Women's Ways of Knowing (WWK) [5], and then critique its use in LIS literature, particularly in the higher education (HE) context.

Educational psychologists Mary Belenky, Blythe McVicker Clinchy, Nancy Goldberger and Jill Tarule[1] set out in the 1980s to investigate their observations that women students often doubted their intellectual capacity, felt "alienated" by formal education, and that "learning" for women was often something that occurred outside of formal education [5]. Building on earlier research by William Perry [11], which had presented a model for epistemological development among primarily male undergraduates, the WWK authors aimed to extend Perry's scheme to incorporate women's experiences.

The study identified five "Ways of Knowing" which are common among women:

1. Silence: voiceless and passive.
2. Received knowledge: capable of receiving knowledge from authoritative sources, but not of producing knowledge.
3. Subjective knowledge: truth is experienced privately, intuitively.
4. Procedural knowledge: using reasoned reflection to construct meaning.
5. Constructed knowledge: all knowledge is contextual, anyone can create knowledge, subjective and objective strategies are both valued [5, p. 15].

In the "procedural" and "constructed" positions, women may also show a preference for either "separate knowing", where the focus is on knowledge as separate from the self; or "connected knowing", where the focus is on understanding and empathy.

The positions are not intended to be linear or sequential. Women may experience them at different points in their lives, move back and forth between positions, and may not experience all of them [5]. Neither are the positions intended to apply to women universally or exclusively, although they may be more common among women [12].

2.1 Women's Way of Knowing in LIS Literature

Julien [9] argues that WWK has unused potential in LIS, having only been able to identify two examples of the model being applied in information behaviour research (including her own doctoral thesis).

Since then, WWK has occasionally appeared as a concept within LIS research, although most citations of WWK within LIS literature merely mention it briefly but do not engage with the model. The four papers outlined below are the few examples identified which discuss and apply WWK in the context of LIS-related research.

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[1] The authors' full names are listed here in respect of their wishes that they receive equal credit, reflecting the collaborative nature of the work, rather than being grouped as "Belenky et al." [10].

In critiquing hierarchical knowledge organisation standards such as Dewey and Library of Congress Subject Headings, Olson [13] uses the concept of connected knowing to propose "a web instead of a hierarchy" (p. 522), as a way of presenting concepts that are connected rather than structured. She discusses in depth how "Connected knowing privileges experience and relies on connections to others to discover what they know" (p. 523), and how this concept could be used to create a feminist knowledge organisation scheme.

In an exploratory paper, Lloyd [14] explicitly links WWK to information literacy, arguing that "information literacy should be viewed as a *way of knowing* about the information environment" [14, p. 89]. In presenting information literacy as a way of knowing, Lloyd draws on the WWK concepts of "received knowing" and "constructed knowing" to describe development from novice to expert.

Westbrook and Fourie [15] propose a three-part "investigation framework" for the information experiences of women with gynaecological cancer, using three "lenses" to examine these experiences: environmental, embodied self, and lifestyle. They use the WWK model to centre their own framework on women's experiences. They include a discussion of "information engagement from the WWK perspective", relating the ways in which gynaecological cancer patients find, share, discover and use information to the ways of knowing identified in WWK.

The most extensive treatment of the WWK model in the LIS literature comes from Fields [16], who examines the Information Literacy Competency Standards for Higher Education [17], comparing them with the WWK epistemological stages. She notes that some foundational IL competencies are likely to be problematic for women in the earlier stages of the WWK model. For example, the performance indicator "Recognizes that existing information can be combined with original thought, experimentation, and/or analysis to produce new information" could be challenging for received knowers, who perceive information as set in stone; or subjective knowers, who may reject information that contradicts their personal experience. Fields uses this comparison to recommend strategies for a woman-centred model of information literacy teaching.

Although each of these papers makes good use of WWK as a lens through which to understand information literacy and behaviour, use of the model within LIS literature in general is underdeveloped. Further potential for the use of WWK in LIS will be discussed in the conclusion to this paper.

3   Intersectional Feminism

Intersectionality, a term credited to Kimberlé Crenshaw [18], is a concept emerging from Black feminism. Crenshaw critiqued the ways in which Black women are multiply disadvantaged: as women, as Black people, and as Black women. The intersections of these identities produce an experience that is distinct from that of Black men, who experience racism but not sexism; and white women, who experience sexism but not racism. Use of the term has developed from this initial conceptualisation to incorporate many different aspects of marginalisation, such as class, disability, and sexuality [3].

Intersectional feminism refers to an approach that moves away from viewing women as a monolithic category of people who experience discrimination and oppression in the

same way, and towards an understanding of how "socially constructed markers" such as race, class, and ethnicity interact [19, p. 833].

Within adult education, intersectionality has been used to understand not just if and how women's learning needs might differ from men's, but how the different life experiences of women and men impact their learning [20]. This is particularly pertinent within male-dominated educational fields, such as science, technology, engineering, and mathematics (STEM). Women who seek training and careers in occupations traditionally defined as masculine are seen as deviating from gender norms, which can lead to backlash from their male peers [21]. They are perceived as both hyper-visible [22] and invisible [23], an experience which is compounded for women who are marginalised in other ways such as by race or disability.

3.1   Intersectionality in LIS Research

Floegel and Costello have argued that intersectionality could assist in developing research that pays attention to the power dynamics in information encounters [24]. They draw from assemblage theory [25], a concept from technofeminism that considers categories such as gender and race as "events, actions, and encounters between bodies, rather than simply entities and attributes of subjects" [26, p. 58].

There is some LIS literature on gender difference in information literacy or information behaviour. However very little considers gender explicitly [27]. Of the research that does discuss gender in-depth, most aims to compare women's and men's behaviours. Few papers either consider women's experiences in their own right, or discuss the intersectional identities of the participants in their studies and how these might contribute to their information experiences.

A literature search of LIS papers published since 2000, for initial exploration of the concept to inform the PhD research, has uncovered a small number of papers relevant to the theme of intersectionality. Some explore the potential sociocultural reasons for gendered differences in information behaviour in HE, while others discuss marginalised women specifically.

Some studies have identified the impact of sex segregation on information behaviour. In Kuwait, sex segregation was perceived to have had a negative effect on learning, as male and female postgraduate students were no longer able to visit the library together or study in mixed groups [28]. In Oman, sex segregation was posited as an explanation for women final-year undergraduates' higher self-ranking of their IL skills: women students are housed on campus, so have better access to the library, while male students live in off-campus accommodation [29].

A recent PhD thesis [30] examined the academic library experiences of Muslim Arabic-speaking women international students in the USA, finding that many had experienced barriers such as a cultural taboo over asking for help. Although some overcame these barriers and learned to use the library effectively, others who had experienced racist or Islamophobic interactions in or around the university were further hampered from making full use of academic libraries.

In a phenomenological study of first-generation students in the USA, Amanda Folk notes that those marginalised beyond their first generation status (for example, by race or sexual identity) were often motivated to use self-selected research assignment topics

as a way to "develop or assert an authoritative voice", and were more likely than their less intrinsically-motivated peers to demonstrate "the modes of critical, analytical and reflective thinking included in the ACRL framework" [31, p. 50]. Although Folk's study did not explicitly address gender as a variable, she notes that social capital is an enabling factor for students' development of information literacy [32]. Social capital has been identified as a potentially important factor in information behaviour, for example in influencing the choice of human information sources and the avenues available to an individual to seek information from others [33]. Marginalised people are likely to have lower social capital, therefore could face barriers to their information seeking and use.

This literature review demonstrates that little LIS literature considers women's identities in a holistic way. Most studies either aim to uncover gendered differences [e.g., 34, 35], or report on gender differences uncovered as part of their overall analysis [e.g., 36, 37]. The studies outlined above are the few examples identified of LIS research that considers the sociocultural context of women's information behaviour (such as the impact of sex segregation in Kuwait and Oman), or how the life experiences of marginalised learners may impact on their information literacy.

4   Conclusion

Both WWK and intersectional feminism are underused in LIS research. As much LIS research on gendered information behaviour within HE has sought only to compare women with men, rather than consider women's needs in isolation, there is a lack of understanding of the different ways in which women's experiences may inform the ways they seek, acquire, and use information. This is where WWK could be useful.

One fruitful avenue could be in considering the role of uncertainty and self-doubt. For example, early development in the procedural knowing stage of WWK is associated with diminished confidence. This echoes findings from LIS research such as Kuhlthau's Information Search Process [38], which identified that uncertainty increases and confidence decreases after the start of a search. If women find doubt and uncertainty in education processes "at best redundant and at worst destructive, confirming the women's own sense of themselves as inadequate knowers" [5, p. 228], then librarians should take this into account when supporting women learners.

WWK also has potential in the understanding of authority and expertise. Tarule [39] notes that without prompting to talk about experts/expertise, most interviewees in the original WWK research spoke about learning new things by asking others or discussing with friends. This could be informative when investigating information seeking and collaborative information behaviour.

Intersectional feminism has also been neglected. Most LIS research that does focus on women tends to consider women as a homogenous group. This may be accounted for by the usually small sample sizes in LIS studies, and frequent quantitative approach: it is not usually possible to analyse data according to multiple axes of marginalisation without a large dataset. However, it should be possible to use qualitative methods to explore how women's lived experiences inform their information behaviour.

WWK itself has also been criticised for its lack of intersectionality, particularly with regards to race [40–42]. Using both WWK and intersectional feminism in combination

would allow for a more detailed, holistic view of the ways in which the life experiences of women impact their information behaviour and information literacy.

The proposed PhD study into the information worlds of women engineering undergraduates will use WWK as a sensitising lens to examine the information behaviour of participants in the study. It will take an intersectional feminist approach to exploring the experiences of women, including an expansive view of "womanhood" (for example, incorporating the perspectives of trans women or nonbinary individuals), to gain an holistic picture of the information worlds of the study participants.

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Clicks, Queries, and Searches: Uncovering User Behavior Through Transaction Log Analysis

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Abstract. This study investigates how transaction log analysis can give insights into the behavior and preferences of AnimoSearch users. Three research questions are addressed in the study: (1) What are the most popular search terms? (2) What are the most often used facets? (3) How do different user segments' search behaviors differ? Findings revealed that exploratory searches were significantly more frequent than known item searches. The most frequently used facets in AnimoSearch were the "Top Level" facet, "Resource Type" facet, and "Date Slider" facet. For basic searching, limiting the search scope to physical resources was the most popular choice across all user segments, and articles were the most frequently selected resource type. The findings provided significant insights that could improve the delivery of research trainings as well as assist developers and vendors in better aligning the design and functionality of the service with user needs.

Keywords: Transaction log analysis · discovery service · information-seeking behavior

1 Introduction

Libraries are constantly adopting new technology and services to better their offerings and suit their patrons' changing information demands. Discovery services, which provide a unified search interface for accessing diverse library materials, have grown in popularity in academic libraries around the world. These allow users to search numerous databases and employ advanced search capabilities such as relevance ranking, filtering, and saving searches. However, in order to verify that these systems are effective in satisfying the demands of users and to improve the search experience, it is imperative to evaluate and assess this type of service using data-driven methodologies. With a growing emphasis on a service-oriented approach, librarians are urged to critically analyze their work and services. Libraries are increasingly required to plan, provide, and evaluate their services using data and evidence, which has increased the demand for attention in academic literature and industry best practices [1].

Transaction log analysis (TLA) is a method that has been widely employed over the years to understand user behavior and enhance system architecture. It is a technique for gathering information and a research technique for analyzing user and system behavior.

An electronic record called a "transaction log" keeps track of user and system interactions. These log files can originate from a variety of sources including websites, online catalogs (OPAC), user computers, blogs, listservs, online newspapers, and other programs that can record user-system information interaction [2]. Transaction logs keep track of all system activity, such as searches, clicks on search results, and access to certain resources. These logs can be studied to learn more about how users interact with the system.

Transaction logs are valuable for librarians because they allow for the analysis of user activity, which helps library management make operational decisions [3]. By examining transaction logs, librarians can uncover common problems and improve the system to better meet user needs [3]. For instance, librarians can use transaction log analysis to determine which resources are being used the most and which ones are not, then decide which resources to promote or drop [1].

The De La Salle University (DLSU) Libraries, which serve almost 25,000 members of the academic community, is composed of a main library and five satellite libraries spread over four campuses. It has a large collection of print and digital resources, including books, periodicals, and multimedia products. Satellite libraries are strategically located on different campuses to meet the needs of specific academic programs. The DLSU Libraries examines and analyzes its services, resources, and systems on a regular basis in order to find areas for improvement and implement creative solutions. This ongoing effort is an attempt to guarantee that the library remains a valuable resource for study and research.

In 2019, Fresnido and Barsaga examined search trends and identified the causes of failure rates by conducting a transaction log analysis of the DLSU Libraries' previous online public access catalog (OPAC). The study's findings revealed that the current OPAC did not match the standards of a next-generation catalog, as evidenced by the issues discovered throughout the log analysis process [4]. Recognizing the need to update its discovery service, the DLSU Libraries launched AnimoSearch in September 2020, a next-generation discovery service powered by Ex Libris Primo that provides a uniform search interface for accessing diverse library contents. It is a discovery platform that harvests and indexes local library collections, such as bibliographic records, full-text articles, and digital objects, making them easily discoverable to users. It has advanced harvesting and normalization capabilities that increase productivity with end-to-end library workflows. It also allows for customization of the discovery service to influence how collections are explored and displayed [5, 6].

The purpose of this study is to investigate the information behavior of AnimoSearch users in order to better understand their information demands and actions during the information-seeking process. The study employs transaction log analysis to evaluate the behavior of AnimoSearch users during the academic year 2021–2022, with an emphasis on detecting trends in user behavior. The study specifically seeks to address the following research questions: (1) What are the most often used search phrases in a discovery service? (2) What are the most frequently used facets, and how do they affect the success of a user's search? (3) How do user search behavior and resource access patterns differ by user segment? The findings of this study will provide insights for improving research training delivery, assisting librarians and developers in better understanding how users

interact with the system, and identifying areas for improvement. Furthermore, the study adds to the expanding body of research on TLA as a method for researching user behavior and preferences, emphasizing the relevance of context in the design and evaluation of information systems.

2   Literature Review

TLA has been used to generate and analyze transaction logs since the 1960s. Peters examined the growth of TLA, its application, and its particular application in assessing online catalog systems in 1993. His research revealed that the first phase of TLA was originally focused on evaluating system performance rather than user behavior, such as the study of Meister and Sullivan in 1967 and Lucas in 1971. But it was during the second phase, from the 1970s until the mid-1980s, when TLA was first applied to the study of online catalog systems. Researchers were interested in studying both how the system was used, such as the selection and order of search choices, and user searching behavior, including session time and error patterns [7–9].

Jansen described a three-stage process for performing web search transaction log analysis, which includes data collection, preparation, and analysis. The article defined key topics in TLA and explored its advantages, such as low-cost and unobtrusive data collection. However, limitations are noted, such as a lack of information on search reasons and searcher motivations. To improve analysis robustness, the author advised integrating TLA with additional approaches [10]. Jones et al. did a transaction log study on the New Zealand Digital Library's Computer Science Technical Reports Collection to better understand user behavior. The research looked at user demographics, search behaviors, query structure, common errors, and interface design concerns. The findings gave important information for enhancing digital library systems [11].

In a discovery system, Behnert and Lewandowski (2017) examined known-item search queries that resulted in zero hits. Based on item availability and query validity, they divided questions into four categories. The study identified acquisition and erroneous searches as the primary causes of zero hits and proposed methods to improve user experience, such as automatic spelling correction. Similarly, Ciota used Primo Analytics to understand patron search strategies at Grinnel College by categorizing the search types into known and exploratory categories. Results showed that known item searches were slightly higher than exploratory search queries [12].

Schlembach et al. investigated user search habits by analyzing transaction logs from a federated search system. The research uncovered information about search characteristics, search help usage, and clickthrough actions. The discoveries aided in the optimization of search and discovery services in dispersed retrieval systems [13]. On the other hand, Agosti et al. gave an in-depth examination of log analysis research in web search engines and digital libraries. They stressed the significance of merging log data with data from other sources in order to gain a comprehensive understanding of user behavior. The report also highlighted research obstacles and new trends in log analysis [14].

Fischer et al. developed a way for analyzing transaction log data from EBSCO Discovery Service (EDS) queries captured in Google Analytics. The authors described how to export data, analyze it, and recreate a search. The study demonstrated the potential of transaction log analysis to enhance system effectiveness, resource utilization, and user instruction in libraries [15]. Meadow and Meadow examined web-scale discovery tools for the quality of their search queries. The study consistently identified high-quality search queries but also areas for improvement, such as user education on effective search strategies and interaction between libraries and vendors [16].

Transaction log analysis has proven to be an effective study tool for gaining a better knowledge of user behavior, system performance, and search tactics in various information retrieval systems. The reviewed research showed TLA's strengths and shortcomings, suggested improvements, and provided insights.

3   Methodology

This study employs a combination of quantitative and qualitative methodologies to uncover user behavior and identify information needs throughTLA. TLA is a research method that analyzes logs to gain insights into how actual users use a system. Transaction logs are files that record every communication or transaction between a system and its users and can be used to collect significant amounts of data on system usage. TLA is considered an unobtrusive method of collecting substantial amounts of usage data on a considerable number of users [10, 17].

The data used in this study is sourced from Primo Analytics, a tool developed by Ex Libris, that provides analytics for libraries using the Primo discovery system. In the context of Primo, transaction logs refer to a record of user interactions with the system. This includes search queries, resource views, and other actions taken by users. Primo Analytics provides various reports that allow libraries to analyze user behavior. I analyzed transaction data from 2021–2022, extracted in CSV format from Primo Action Usage, Primo Facet Usage, and Primo Popular Searches reports.

The qualitative aspect of this study focused on categorizing the popular searches identified in the Primo Popular Searches report. For the analysis, we utilized the top fifty rankings from the report for the years 2021 and 2022, resulting in a total of 805 search queries. The classification scheme used was adopted from Rebecca Cioti's report entitled "Using Primo Analytics to Understand Patron Search Strategies." This involved known popular searches, such as specific book titles or authors, and exploratory popular searches that may reveal user interests and behaviors [12].

4   Results and Discussion

4.1   Most Commonly Used Search Terms in AnimoSearch

Search Queries. The results of this study revealed a diverse range of topics that are of interest to AnimoSearch users, indicating the usefulness and applicability of the search engine in various contexts. Table 1 displays the top fifty AnimoSearch search queries and the number of times each query was searched.

Table 1. Top 50 search queries used by AnimoSearch users

Search Query	No. of Searches	Search Query	No. of Searches
1. develop	1,324	26. Philippines	180
2. Euromonitor	1,164	27. online learning	176
3. Covid 19	755	28. importance of starting your own business	172
4. Jstor	726		
5. covid and mental health	671	29. action research	171
6. thesis	464	30. management	167
7. mental health	456	31. social_sciences	157
8. Statista	417	32. college accounting	154
9. IEEE	340	33. chinese military modernization and force development	152
10. business_economics	339		
11. turnitin	312	34. philosophy	149
12. effectiveness of e-commerce platforms in a pandemic	306	35. organizational communication	146
		36. business related	144
		37. philippine literature in english	144
13. test	301	38. Science Direct	144
14. marketing	293	39. students concentration	142
15. accounting	290	40. oligarchy in the philippines	141
16. Scopus	257	41. agricultural land	137
17. essential mathematics for the modern world	251	42. philippine literature	129
		43. artificial intelligence	128
18. social media	247	44. social media and e commerce during covid-19	124
19. public health	232		
20. biography	213	45. CDAsia	122
21. middle childhood	204	46. energy system	122
22. artificial intelligence, sustainable development		47. science	120
		48. system study	120
23. sustainable development	195	49. impact of covid-19 to entrepreneurs	118
24. psychology	195		
25. sustainable development goals	190 186	50. microfinance in the philippines	117

The predominance of COVID-19-related search queries demonstrates the pandemic's persistent influence on society and the need for reliable information and tools. One notable finding was the prevalence of search queries for popular database titles such as Euromonitor, JSTOR, Scopus, and Science Direct. This behavior indicated that users were using AnimoSearch as a means to access scholarly databases. However, it is essential to note that users may not have been aware that a better alternative to accessing the database directly is using the A-Z directory on a different webpage. They may perceive that AnimoSearch functions the same way that search engines, like Google, work. Moreover, the broad spectrum of topics searched in AnimoSearch in the areas of management, business, economics, philosophy, psychology, politics, and science highlights the utility of AnimoSearch as an academic research platform. It also indicates the significance of keeping a database of scholarly literature that covers multiple disciplines.

The types of search queries also d helpful insight into how patrons use these searches to locate information. Many of the search terms used, such as "development," "science," or "test," are too broad or vague, which can lead to a large number of irrelevant results that may not be useful for their research. Furthermore, users may be unaware of advanced search tools and strategies that can help them refine their queries and locate more relevant content. Users can find more relevant information by using methods such as Boolean operators, enclosing search phrases in quotation marks, or utilizing filters.

These findings highlighted the importance of teaching patrons how to refine their search terms and use more specific keywords directly related to their research topic. This can help them find the most relevant and valuable information in a shorter amount of time. Additionally, patrons may also be more trained to use advanced search techniques such as Boolean operators or limiters to further refine their search results. By understanding how patrons used these searches and providing guidance on how to refine them, librarians can help ensure that patrons are able to find the information they need efficiently and effectively.

Known-İtem and Exploratory Searches. The sample queries were categorized into known item and exploratory search types. "Known item searches" refer to the activities carried out by searchers who have a particular item in mind. The searcher comes to the database with the knowledge that the search target exists and with specific information about it, such as the author, title, or subject. The goal of a "known item" search is to locate a specific information source, such as a book, journal, article, video, or website, that the searcher already knows something about [18].

On the other hand, exploratory search in library catalogs refers to the process of searching for information when the searcher is unfamiliar with the domain of their search goal and unsure about the ways to achieve their objective. It is a type of information exploration that involves preliminary, initial, and novice searching. Exploratory searching is used to identify relevant resources and to develop a better understanding of the topic being researched [19].

Table 2 provides an overview of the distribution of search types across the different search types. Out of 805, 188 queries (23.35%) were classified as known items, indicating that researchers were looking for specific information. The bulk of searches, 613 (76.15%), were exploratory in nature, as researchers sought general information or explored themes of interest. Only four queries (0.50%) were recognized as having inadequate information, indicating challenges owing to a lack of data. These findings are in contrast with the studies conducted by Schlembach et al. and Mischo et al. that reported a higher proportion of known items than exploratory searches. In their papers, results indicated that known item searches constituted around 63.00% and 55.00% of search sessions, respectively [13, 20].

Table 2. Search types and strategies employed by AnimoSearch users

Search Type	Search Strategy	Number of Occurence	Percentage
Known Item		**188**	**23.35%**
	Title	131	69.68%
	Author, Title	21	11.17%
	Author	16	8.51%
	Website link	9	4.79%
	Call Number	5	2.66%
	DOI	5	2.66%
	ISBN	1	0.53%
Exploratory		**613**	**76.15%**
	Keyword	530	86.46%
	Subject	69	11.26%
	Person	14	2.28%
Not enough information		**4**	**0.50%**
Total		**805**	

Out of 188 known item searches, the most common approach was searching by title (131 searches, or 69.68%). This suggested that researchers mainly used the title to find specific items. The second most common strategy was combining the author's name with the title (21 searches, or 11.17%), indicating that researchers used both criteria to refine their search. Searching by author alone was used in 16 searches (8.51%), showing that researchers were interested in finding items by specific authors.

Other search strategies included using call numbers (2.66%), DOIs (2.66%), and website links (4.79%). These methods were used to locate known items through library classification systems, unique digital identifiers, and direct online sources, respectively. Only one search (0.53%) used the International Standard Book Number (ISBN) to find a specific book. Data showed that researchers mainly relied on titles and a combination of author and title searches to find known items.

What known items are users looking for? Results reveal that the most common type of item searched for was "Book and Book Chapter" and "Article" constituting 41.49% (n = 78) and 36.70% (n = 69) of the total searches, respectively. Additionally, "Thesis and Dissertation" accounted for 7.45% (n = 14) of the total searches. These findings suggested the significance of scholarly and academic literature in the users information seeking process. Other item types such as "Database" (12 or 6.38%), "Media" (6 or 3.19%), "Journal Title " (5 or 2.66%), "Webpage" (3 or 1.60%) and "Newspaper article" (1 or 0.53%) accounted for a smaller proportion of the total searches. The results highlighted that, while these item types represent a smaller percentage, they still played a valuable role in complementing the users' search strategies, and they utilized various resources to support their studies.

Number of Words in Search Queries. Findings revealed that the average number of words per question was calculated at 4.30. The majority of user search queries consist of one or two words. The results closely match those of Schlembach et al. who reported that users of their library catalog system entered an average of 4.33 words for each search request [13]. The frequency of occurrence for one-word inquiries is 134 (16.65%), whereas it was somewhat higher for two-word queries, at 203 (25.22%). This suggested that many people prefer to enter brief searches with few words.

As the number of terms in a query exceeded two, the frequency of occurrence gradually decreased. Three-word questions had a frequency of 122, followed by four-word queries at 93. The downward trend continued for five-word inquiries (60), six-word queries (57), and seven-word queries (32). Data showed that the frequency rose again for questions with more than ten words, with a frequency of 57. This implied that a subset of users entered lengthier and more specific inquiries, indicating a need for extensive and comprehensive search results. Results illustrated that shorter inquiries were more popular, while lengthier queries had a smaller but noticeable presence. Understanding the distribution of query lengths can be useful for search engine optimization and for creating successful information retrieval systems.

4.2   Most Frequently Used Facets and Their Impact on Search Success

This analysis examined the impact of different facets on the success of users' searches in AnimoSearch and their significance for improving search functionality and user experience. Table 3 shows that the "Top Level" facet was the most frequently used, with an average of 146,362 selections, indicating its importance in providing users with a starting point for their searches. This was followed by "Resource Type," which was selected an average of 95,590 times. This facet provided users with the option to further filter results by item types such as articles, books, theses and dissertations, and many others. The "Date Slider" facet was selected an average of 67,808 times, suggesting that users value specifying a date range to access relevant and up-to-date information. Other facets such as "Topic," "Collection," and "Library" were used less frequently, while the "Author" facet had the lowest usage. These findings can inform improvements to AnimoSearch by enhancing the presentation and usability of frequently used facets and ensuring the accuracy and comprehensiveness of search options.

Understanding how these factors affected search success helps enhance search functionality and user experience. Users can navigate the search interface better by improving the "Top Level" facet, which is utilized most often. Accurate resource types, date range options, and topic categories can also improve search results. These insights can inform the design and development of AnimoSearch to increase usability, search success rates, and user experience.

Table 3. Frequency of facet selection in AnimoSearch

Facet	Average number of times the facet has been selected
Top Level	146,362
Resource Type	95,590
Date Slider	67,808
Topic	35,920
Collection	15,961
Library	2,855
Author	91

The top-level facet provides users with options to refine their searches and access relevant resources based on specific criteria. It is important to note that the availability and specific facets used in Primo may vary depending on the configuration and customization of individual Primo implementations. In AnimoSearch, users can further tweak their results in terms of availability and type of access, namely: Peer reviewed journals, Full-text Online, Open Access and Available in the Library. Filtering results by Peer-reviewed Journals" tops the selections, followed by Full-Text online facet while the Available in the Library was the least used facet.

Looking at user preferences for resource types, Table 4 shows that "Articles" was the most popular resource type with 43,945 selections. Users favored articles as a primary source of information and may have been sought after for their depth and scholarship. "Books" was selected 11,075 times, implying that users valued books as a resource for in-depth research. "Dissertations" ranks third in user picks with 8,995 instances. This suggested that users were interested in academic dissertations, which present original research and analysis. Users seeking in-depth and specialized information can benefit from dissertations.

With 5,405 selections, "Newspaper Articles" was also popular. Newspapers offer current news and information, suggesting users value it. Newspapers provide timely coverage of events, opinions, and other significant issues. With 4,720 and 4,671 selections, "Book Chapters" and "Reviews" were relatively popular. This suggested that users valued reading book chapters and reviews to learn about certain topics or evaluate resources. "Journals" had 3,091 selections, demonstrating that users actively sought specific journals to read articles and intellectual content published inside them. While other resources types, such as "Text Resources," "Newsletter Articles," "Conference Proceedings," and "Market Research," also received varied user selections, suggesting distinct study interests and needs.

These data indicated that users preferred peer-reviewed material. Users also showed interest in books, dissertations, and newspaper articles, emphasizing the need for broad and updated knowledge sources. Users' concentration on specific areas or resource quality was shown by their choice of resource types, such as book chapters and reviews. These findings indicated a varied user base with diverse needs, as users sought a wide range

Table 4. User preferences for resource types

Resource type	No. of times selected	Resource type	No. of times selected
Articles	43,945	Journals	3,091
Books	11,075	Text Resources	2,055
Dissertations	8,995	Newsletter Articles	1,611
Newspaper Articles	5,405	Conference Proceedings	1,574
Book Chapters	4,720	Market Researches	1,182
Reviews	4,671	Databases	2

of resources to support their research and information needs. Understanding these patterns of resource type selection helps inform the creation and customization of the AnimoSearch system, ensuring that users can simply access and navigate the most desired resource types for a better user experience.

4.3 Variation in Search Behavior by User Segment

Through Primo Analytics, various actions conducted by AnimoSearch users while interacting with the service were recorded and summarized. This allowed for analyzing the difference in behavior and preferences per user segment.

The top ten user actions in AnimoSearch shed light on their preferences and behavior during interactions with the system (see Table 5). Of the 141 action types, the most popular activity was the use of basic search, which had 973,985 occurrences, demonstrating that users regularly used the search functionality to find specific objects or information. Displaying the full record of an item was closely followed by 922,116 instances, indicating great interest in getting thorough details or metadata. The third most popular activity was clicking on an item's title, which occurred 337,905 times, showing users' willingness to explore further information or inspect the item itself. Navigating to the next page of search results or item lists was also popular, with 249,283 instances of the "Next page" action. Users checked availability statements frequently, executing the "Click on availability statement" action 218,364 times.

On the other hand, users used the advanced search tool 200,212 times, showing a need for more refined or particular searches. Facet filtering was also popular, with 130,410 instances reflecting users' desire for limiting search results based on specified criteria. Creating or accessing citations for items was another typical action, occuring 71,974 times. Users clicked on "Main Menu Link 1" 68,885 times, indicating its significance as a navigation feature. Finally, the "AZ list" action occurred 33,744 times, suggesting users' tendency to browse or locate certain things alphabetically.

The results highlight the most popular activities of the users as they engaged with the discovery service. This information helps prioritize features and functionalities that align with user preferences, as evidenced by the high frequency of certain actions. On the other hand, this could also help in the modification of the interface if there are certain

actions that the library wants the user to make use more of. For example, making the Advanced Search more visible may increase the use of this functionality.

Table 5. Top 10 user actions in AnimoSearch

Action Type	No. of occurrences	Action Type	No. of occurences
Basic search	973,985	Advanced search	200,212
Display full record	922,116	Facet filtering	130,410
Click on title	337,905	Citation	71,974
Next page	249,283	Main Menu Link	68,885
Click on availability statement	218,364	AZ list	33,744

When performing a basic search in AnimoSearch, users have the option to select the search scope. Search scope defines where the system should perform the search. There are three predefined search scopes: Everything (default), Online Resources, and Physical Resources. A user who chooses to search in Everything will get the available materials provided by the DLSU Libraries regardless of format.

The frequency with which the various search scopes are selected in AnimoSearch by different user segments was also examined. It showed that the Guest user category had the highest frequency in all search scopes. Ranking their preferences in terms of search scope selection, Gradudate, Undergraduate, and Senior High School (SHS) students exhibited a similar pattern where they mostly used Physical Resources, followed by Everything then lastly, the Online Resources. For Faculty, Physical Resource selection topped the rank as well but their second most used scope was Online Resources. With only 161 (Everything) and 2,370 (Physical Resources) occurrences, the Staff user group had the lowest frequency of selecting search scopes. Overall, data showed that when logged in, users mostly searched Physical Resources first, while guests (not logged in) employed the default search scope option, which is Everything.

Table 6 presents the breakdown of facet usage by different user groups in AnimoSearch. Findings revealed that facet usage varied across user segments. Faculty members mostly used the Resource Type facet, followed by Topic, and Date Slider, while Graduates mostly preferred to use Collection, Topic and Resource Type. For the Undergraduates, their top three facets included Resource Type, Top Level and Date Slider, which indicated they are more particular in selecting resource format or type of information resource to streamline their research process and retrieve more targeted results. Senior High School mirrored this behavior but in a much lesser frequency. This is understandable, as the number of SHS students was much lower than that of undergraduates. Staff have the least number of interactions with the system, and showed that they mostly use Resource Type, Date Slider, and Topic facets. Guests, on the other hand, were those unsigned AnimoSearch users that belong to any of the abovementioned user segments. Overall, Guests users most frequently used the Top Level facet as well as the Resource Type and Date Slider facets. The table further shows that overall, Top level was the

most used facet in AnimoSearch, while Author was the least. These findings provided valuable evidence that each user segment varies in terms of actions and preferences.

Table 6. Percentage of facet usage by user groups in AnimoSearch

User Group	Facet Type Usage (in Percent)						
	Author	Collection	Date Slider	Library	Resource Type	Top level	Topic
Faculty	1.10	10.57	5.99	2.21	11.70	2.35	18.11
Graduate	4.40	45.54	8.75	5.19	9.05	11.25	17.31
Guest	78.02	28.46	46.04	73.15	40.56	46.41	32.37
Senior High School	5.49	2.21	8.20	1.09	7.43	11.58	6.46
Staff	0.00	0.26	1.44	3.86	1.28	0.13	0.81
Undergraduate	10.99	12.96	29.58	14.51	29.98	28.28	24.93

5   Conclusion

This study provides valuable insights into the search behavior and preferences of AnimoSearch users. It revealed a diverse range of popular search terms used by AnimoSearch users, including COVID-19-related queries and popular database titles such as Euromonitor, JSTOR, and Scopus. The search queries examined revealed that more than 75.00% of the searches were exploratory. For known item searches, title was the most common search strategy, and articles are the most common item type searched. On average, users used 4.3 terms per search string. Findings also revealed that users tended to search using broad terms and rarely use techniques that may help them refine their search.

In terms of facet selection, the most frequently used facets in AnimoSearch were the "Top Level" facet, "Resource Type" facet, "Date Slider" facet, and "Topic," "Collection," and "Library" facet. The analysis of user actions in AnimoSearch revealed little variation in search behavior among different user segments when it came to facet selection and search scope selection. Basic search was the most popular activity across user segments, with articles being the most frequently selected resource type, followed by books and dissertations.

In conclusion, AnimoSearch proves to be a well-utilized tool by users to discover a diverse range of academic resources. However, students would benefit from improving their understanding of advanced search tools and techniques. While the current reseach instruction program at DLSU Libraries includes teaching this skill, it would be beneficial if this area will be given more emphasis by providing additional tutorials and guides. Additionally, although advanced search is clearly visible in the interface, it is still less frequently used than basic search. It is necessary to find a better strategy to encourage users to use this feature more. Finally, it is important to note thatTLA, such as the one

conducted in this study, does not provide context for user behavior. Therefore, it is highly recommended that further studies be undertaken to explore the motivations and contextual factors behind user behavior when using AnimoSearch. This will provide a more comprehensive understanding of how users interact with the platform and will help guide future improvements.

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Early-Career School Librarians' Use of Information Literacy Skills to Master Their Information Needs

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Abstract. Though a tenet of school librarianship, early-career school librarians do not enter the field with a strong foundation in information literacy. Many have experience as classroom teachers yet are unaware of the job-related demands to be successful as a school librarian. The authors provide an overview of those responsibilities, the task of preparation programs to address gaps in understanding, and the results from a recent mixed-methods study in the United States exploring the professional information needs of early-career school librarians and library school students. Results revealed the source of support for these individuals resides in participation in professional learning communities and strong mentoring, provided and encouraged by their employer and preparation program, and intentionality to support their information literacy skills to foster expertise in the field.

Keywords: School librarian information need · information literacy · school librarianship · information needs

1   Introduction

Information literacy is a tenet of school librarianship [1–4]. Although most school librarians in the United States (U.S.) were once classroom teachers, aspiring librarians do not always possess a strong foundation in information literacy skills prior to entering their preparation program or in the early stages of their career [5] even though it has been shown that the students of teachers who possess these skills have higher levels of information literacy themselves [6]. For the purposes of this paper, information literacy, also commonly referred to as information competency or information fluency, is defined by the American Library Association as an individual's ability to recognize when information is needed, and have the ability to locate, critically evaluate, and effectively synthesize or use the found information [7] in every day, academic, or professional contexts.

Do library school students leave their preparation programs with the skills to answer their own information needs? Does preparation for the profession encompass essential skills necessary for success? [8] In the authors' experience, early-career school librarians

identify difficulty in the transition from classroom teacher to school librarian, particularly in fulfilling job-related information needs. In this paper, the authors will provide an overview of the responsibilities and information necessary to meet those responsibilities while sharing selected results from the authors' recent study exploring the professional information needs and literacies of early-career school librarians and library school students wishing to become school librarians. Utilizing a mixed-method approach, surveys and interviews were used to explore and understand the information needs of participants as well as ways they met those information needs.

2   Preparation of Future School Librarians

While there are some exceptions, school library educator preparation programs in the U.S. require that applicants have classroom experience. This means most future school librarians have been trained in a teacher or educator preparation program. However, this is not the case in all countries and there may not be educator preparation programs in place to specifically support candidates seeking to become school librarians. While the need is recognized, there is fairly uneven coverage [9].

In educator preparation programs for school librarianship, standards drive the work. The International Federation of Library Associations and Institutions (IFLA), in association with the International Association of School Librarians (IASL), produced general guidelines for educator preparation globally [10]. These guidelines were created to help ensure that all school communities have access to quality library programs and support the preparation of the professional school librarian. In the U.S., the American Association of School Librarians in partnership with the American Library Association (ALA) and the International Society for Technology in Education (ISTE) regularly update guidelines for school librarian educator preparation programs [11]. Additionally, states provide standards for school library programming, and these are woven into each state's preparation programs and certification or licensure requirements. For instance, the state of Texas has created its own standards that all educator preparation programs, including those for school librarians, must follow [12]. State-level standards are also updated fairly regularly.

In application, curriculum is constructed around each governing entity's educator preparation standards while also attempting to prepare them for day-to-day operational expectations of the profession. Some U.S. preparation programs have integrated opportunities for students to participate in collaborative activities, portfolio development, and internships to provide preparation beyond the state and national standards. Similarly, in a preparation program's lesson development to teach library skills (information literacy, media literacy, and the like), library schools utilize the National Library Standards, also developed by AASL [13]. In the U.S., students must demonstrate mastery of these standards, or competencies, before being licensed. Most take a certification examination to be able to work as a school library professional in early childhood through grade 12 (EC-12) schools. Information literacy skills - how to determine information need, where to look for pertinent information, how best to evaluate and present or apply findings, and so on - are part of the preparation program.

2.1   Background and Information Literacy Skills of Potential School Librarians

School librarians in the U.S. must have a teaching license and be endorsed in the field of school librarianship as defined by each state [14]. Teacher training can be part of a bachelor's degree or as an alternative certification process, where a holder of a bachelor's degree in a field takes coursework to obtain the teaching license.

Existing research has demonstrated that age and school level affect the information literacy skills of classroom teachers and that they often are not equivalent to the skills of degreed librarians [15]. Chen et al. [16], Sun and Xie [17], and Latif et al. [18] discovered a negative correlation between age and information literacy level, meaning the older the individual teacher, the less information literate. Chen et al. [16] also found that classroom teachers' information literacy was proportional to the grades they teach, with elementary teachers scoring the lowest overall. In addition to these factors shaping overall information literacy of classroom teachers, Shipman et al. [19] found that classroom teachers' information seeking behavior relied significantly on websites and colleagues or peers when addressing their professional work rather than library-related resources.

Library school applicants, therefore, do not innately come to the profession adequately prepared. Applicants to school library programs in the U.S. generally have been trained as classroom teachers prior to beginning studies in their library school preparation program, many with at least two years in the classroom before applying. Their prior training has been specifically focused on how students learn and how best to teach them based on their ability and age level. Because this training often only addresses the ability to use digital tools and/or technology to achieve a specific purpose, classroom teachers do not necessarily have the information literacy skills professional librarians rely upon, including information need identification, knowing where to find the information to satisfy the need, or evaluating the found information [20]. Library school applicants therefore do not come to the profession with adequate information literacy skills.

For both library school students and early-career professional school librarians, the notion of "information need" may be difficult to define. Applicants decide to obtain a school librarian endorsement for many reasons. Driving factors include perceived flexibility, sharing a love of reading, and other factors [21]. They do not recognize their own information-seeking skill deficit. As they proceed through the program, they begin to realize what they do not know, not only about the profession itself, but also how to identify and satisfy their information needs.

2.2   Perceptions of the School Librarian Profession

Library school students sometimes feel that they know the skills and abilities necessary to become a good school librarian. Through direct observation and interaction with school librarians in their past experiences, they believe that they understand how the position fits into the larger school community. However, during their coursework in the librarian preparation program they begin to understand that their perception of the position is inconsistent with the reality of the role. Overall, school library preparation programs support the school librarian candidate's skill development. However, the situated learning that takes place does not complete their education, leaving gaps in developing students' contextual information seeking behaviors that could further their transition to and success

as school librarians. This is not specific to school librarianship. Lave and Wenger have studied this phenomenon extensively [22–24] and conclude that implicit knowledge in communities of practice allows for better understanding of the work and how best to complete it.

3   Role of the School Librarian

3.1   School Librarian Responsibilities

The school librarian is a facilities manager, budget manager, collection developer, instructional technologist, teacher, leader, collaborator, and information specialist in the school community in the U.S. [25]. Usually, school librarians are the only professional librarians on their campuses and may be responsible for more than one campus. Ultimately, they are responsible for teaching and supporting information literacy for students and fellow educators on their campuses.

In library school, information literacy and how to meet one's information needs is integral to the program. Library school students in the U.S. are shown different models for teaching information literacy to their students that is age-appropriate, including Big 6 and Super 3 [26]. They learn to write and conduct information literacy lessons for both their students and their colleagues, including ways to uncover information needs. Since the publication of the National School Library Standards in 2018 [1, 2], educator preparation programs emphasize that the Information Search Process (ISP) model aligns best with these standards and aligns well with information literacy instruction [27, 28]. Library school students learn the six stages of information-seeking and build this understanding into their library instruction through direct experience. The reason this model is more suited to library instruction with the National Library Standards is that it considers the different challenges encountered during search. It is seen as a holistic model, taking in all the experiences students encounter, including emotional experiences, and building support for all of them. Library school graduates use this or other models to train their own students to be ethical seekers of information. They note that their own methods of teaching information-seeking as classroom teachers did not work as well as these models. Further, students who teach in the classroom also rely on their experiences as undergraduates, and these are not adequate to train EC-12 students in critical thinking regarding sources of reliable information.

3.2   School Librarian Information Needs

From a practical standpoint, educator preparation programs such as school librarian programs hew closely to educator preparation standards. In the U.S., these Standards can be found in the ALA/AASL/CAEP School Librarian Preparation Standards [10] and consist of five Standards and their sub-strands for educator preparation programs. Information literacy is covered in these Standards, but only as it applies to teaching and learning in the EC-12 environment. It does not intentionally include how to meet the school librarian's information needs as it pertains to the position of school librarian. These needs may include understanding terminology of budget, how to order and prepare

books for the library shelf, how to build a calendar for the use of the facility, and other aspects of the day-to-day implementation of the library program, all of which are common responsibilities of school librarians in the U.S. Early career school librarians are trained in some of these areas, but in others the only way to learn the requirements is to work in the position. A program for educator preparation is by nature theoretical rather than practical. For this reason, educator preparation programs do not generally approach granular topics, such as those noted previously. Some of these topics are seen and discussed in a practicum or internship, but the intern will not be primarily responsible for the school library until they obtain a professional librarian position within a school.

3.3 Information Pipelines

As school librarian positions vary from place to place, the ways of identifying and meeting information needs also vary. Some school districts have extensive networks that support and mentor their new school librarians. Others, possibly assuming that the school librarian is also a teacher and ostensibly should know where to go to answer information questions, do not provide much in the way of mentorship. School librarians are ultimately left to their own intrinsic motivation and expertise (or not) to identify and satisfy their own job-embedded information needs.

4 Exploring the Gap

A large portion of a school librarian's work in the U.S. involves the understanding of information literacy, trends in information-seeking behaviors by their EC-12 students and colleagues, and supporting the developmental and cognitive needs of their patrons. Similarly, in their quest to resolve their own job-embedded information needs, information literacy skills, critical thinking, and an awareness of their own information seeking behavior is tangential to their success and longevity in the profession.

In a study published earlier this year, the authors sought to discover if pre-service and early-career school librarians felt their preparation programs were adequately equipping them with the necessary information literacy and information seeking skills and behaviors to be successful. Similarly, though most had prior training as educators, the study also sought to determine if the participants felt they were prepared to teach those they serve the necessary skills to be successful information seekers and information literate lifelong learners [29]. The results would assist preparation programs in assessing their curriculum to better meet the needs of library school students.

4.1 Method

The authors used a mixed method research design which included an online survey and web-based interviews and received institutional review board approval from the authors' institution. The blend of methods made it possible to gather quantitative and qualitative data from participants across a wide geographic area in the U.S. while authentically capturing their experiences and personal reflections.

Participants included library school students with prior classroom teaching experience but no professional school library experience, library school students concurrently serving in the school library professionally, some with 0–5 years' experience as a professional educator or professional school librarian and others with more than 5 years' experience.

The study focused on the experiences of the early-career school librarian; therefore, respondents with more than 5 years' experience were not included in the overall analysis. Future data collection will resemble the initial distribution with adjustments to include the experiences and perceptions of middle- to late-career school librarians.

4.2   Selected Findings

The online survey received 57 participant responses self-identifying as pre-service or early-career school librarians from a convenience sampling representing 42 institutions with school librarian preparation (SLP) or equivalent programs in the U.S. Of the 57 responses, the majority reported having over 15 years' experience as a classroom teacher (33.33%), followed closely by 31.58% with less than 5 years' classroom teaching experience.

The authors originally sought to determine if school librarian preparation programs were adequately preparing students for their professional duties as school librarians and if they were then equipped to fulfill their own job-related information needs. In the online survey, participants were asked to rate whether their preparation program prepared them for general librarianship tasks including collaboration, scheduling, collection management, student knowledge and skills content standards, budget management, management and coordination of staff and volunteers, maker spaces, and conducting action research. Of the tasks included in this set, each had at least one librarian who felt underprepared, as seen in Table 1.

As mentioned previously, most pre-service and early-career school librarians in the U.S. embark on a school librarian preparation program with prior classroom teaching experience. The assumption could therefore lean toward prior expertise in or an awareness of instructional strategies and lesson development. A second task set asked participants to consider whether their preparation program prepared them to address student needs. Shown in Table 2, the items in this set included collaborating with instructors to address learning objectives, teach information and maker literacies and digital citizenship, and connect content standards and campus instructional goals to library instruction. The areas in which participants felt their preparation program prepared them the least was in teaching maker literacies and aligning campus instructional goals to library instruction, though there were other concerns mentioned by at least one participant.

When participants were asked to consider how their understanding of information literacy had changed since entering library school, 69.77% (n = 43) said it had changed "somewhat" to "significantly", in particular among those that had completed library school. Similarly, 43.18% (n = 44) participants reported that they believed their perception or understanding of the school library profession had changed "significantly" during their coursework. This was echoed in the qualitative data collected during web-based participant interviews. Much of their paradigm shift revolved around the emphasis on technology literacy – educational technology, digital learning, maker technology,

Table 1. General librarianship tasks

I believe my SLP adequately prepares/d me to… (n = 44)	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I haven't encountered this topic
Collaborate with others	54.55%	34.09%	4.55%	0.00%	6.82%
Schedule classes/programs	31.82%	50.00%	6.82%	2.27%	9.09%
Manage the library collection	56.82%	34.09%	2.27%	0.00%	6.82%
Address content standards in the library collection	52.27%	34.09%	4.55%	0.00%	9.09%
Manage a library budget	34.09%	43.18%	6.82%	6.82%	9.09%
Manage library staff	29.55%	38.64%	18.18%	4.55%	9.09%
Manage student or adult volunteers	34.09%	36.36%	15.91%	4.55%	9.09%
Manage a maker space	25.00%	38.64%	22.73%	4.55%	9.09%
Conduct action research	31.82%	38.64%	15.91%	4.55%	9.09%

Table 2. Librarianship duties supporting student learning

I believe my SLP adequately prepares/d me to… (n = 41)	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I haven't encountered this topic
Collaborate with others to address student needs	56.10%	31.71%	2.44%	0.00%	9.76%
Teach information literacy	58.54%	29.27%	4.88%	0.00%	7.32%
Teach digital citizenship	63.41%	21.95%	7.32%	0.00%	7.32%

Table 2. (*continued*)

I believe my SLP adequately prepares/d me to… (n = 41)	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I haven't encountered this topic
Teach maker literacies	29.27%	34.15%	19.51%	2.44%	14.63%
Address content standards in library instruction	48.78%	34.15%	7.32%	0.00%	9.76%
Address campus instructional needs or goals in library instruction	46.34%	31.71%	12.20%	0.00%	9.76%

supporting technology integration into instruction, technology troubleshooting, and job-related technology – in their regular duties as the school librarian. Participants who were preservice and early-career school librarians said they had not expected the heavy emphasis on technology and information literacy skills, sharing that most of their experience with prior school librarians reflected the common misperception that librarians "just read books".

For a more in-depth examination of the data collection instruments and findings, see the authors' article, Information Literacy in Context: Skill Development in Pre- and In-Service School Librarians, in the Peabody Journal of Education [29].

5 Discussion

Survey and interview responses clearly revealed that school librarians experience a significant change in their understanding of information literacy and the school library profession during their time in library school and early years in the profession, indicating a paradigm shift as these classroom teachers become information professionals. They begin to realize that being a school librarian is not just "reading books" and sharing a love of reading with students, but that they are responsible for maintaining a cohesive library collection, building information literacy skills in others, supporting and augmenting curriculum standards and campus instructional goals, leading others in day-to-day operations of a space, among other responsibilities. They may also determine that their own information literacy skills need work.

The data gathered reinforces the premise that early-career librarians are leaving their library school programs with gaps in their knowledge regarding the work they will and are performing in practice. Significant gaps were identified in the areas of

- technology tools, use, and support,

- maker literacies and how to teach them,
- addressing content standards and campus instructional needs in library instruction, and
- operational management of a school library, which are represented in Table 1 and Table 2.

In addressing these practice-based, knowledge gaps as they appeared, early-career school librarians demonstrated their own information literacy skills.

The authors discovered through interview responses that early-career librarians had difficulty equating the gaps in their knowledge with a need for information. In not seeing or acknowledging the gap as a need for information, early career librarians' information seeking behavior tended to seek knowledge from dynamic, informal information sources, including social media, blogs, videos, and colleagues, while generally ignoring or not realizing that static, formal information sources could contain the needed information as well. This situation may be exacerbated by the cognitive overload early-career librarians experience, many of whom are holding positions on an emergency certificate. Some of the overload can be attributed to their attempt to do the work while simultaneously learning their collection, space, campus, and navigating new relationships with administrators, instructional staff colleagues, paraprofessionals, students, and volunteers.

Perhaps the largest source of informal information and/or support was being sought through people, specifically early-career school librarians' Professional Learning Communities (PLCs) or Networks (PLNs). Participants acknowledged the authority of individuals in these groups to address various topics by recognizing their prior experience or knowledge and/or receiving recommendations from peer colleagues. Though participants did not elaborate further on their information evaluation process, the authors can postulate that early-career librarians unconsciously paired the evaluation of authority with that of currency, relevance, and purpose in determining the value of the information gathered. The authors cannot, however, identify how or if accuracy of the information was assessed. Participant responses do indicate that early-career librarians were able to determine when they had gathered enough information and used that information to address the gap in their knowledge, regardless of topic. Some participants indicated that they probably could have addressed their need more completely but did not in the interest of competing priorities and timelines.

6   Conclusions

In this paper, the authors provided a holistic view of the early-career school librarian, their responsibilities, and the information necessary to meet those responsibilities while sharing selected results from a recent study exploring the professional information needs of early-career school librarians and library school students seeking to become school librarians. Based on the data collected, the authors have drawn several conclusions regarding early-career school librarians' personal information literacy skills in addressing an information need and how school librarian preparation programs and school administration can support the success of these individuals.

The gathered data and existing literature agree that applicants to school library preparation programs are generally unaware of the breadth of duties and responsibilities of

the profession and the information literacy skills needed to be successful. It is important for school librarian preparation programs to recognize and acknowledge this disparity of skill and professional understanding in their incoming students and develop strategies to build these skills and knowledge throughout the program to increase the success of their graduates. School library preparation programs should also cultivate a culture of transparency and advocacy in the work of school librarians and encourage graduates to continue this practice throughout their careers to educate others and demonstrate the continued worth of the profession.

The study revealed that early-career librarians do leave their preparation programs with gaps in their knowledge of the practical, day-to-day work school librarians perform. Areas with significant gaps include technology literacy, maker literacy, supporting curriculum standards and campus instructional goals in library instruction, and operations such as budgeting, scheduling, and supervision of staff or volunteers. The authors acknowledge that no preparation program could possibly address all topics needed for professional success; however, it is important to recognize that knowledge gaps will exist, to communicate that eventuality to students, and to help prepare them to overcome the gaps.

The authors discovered in the process of this study, that early-career librarians have difficulty transferring their information literacy skills from the academic environment to the real-world in addressing their job-related knowledge gaps. This paired with the cognitive overload experienced by early-career school librarians, revealed a tendency to seek out dynamic, informal information sources, particularly other people, to address their need. This tendency could be leveraged by school administrators in the successful onboarding of new early-career school librarians by developing a network of mentors, from campus and the wider school community, that the librarian could meet with to orientate them to various aspects of the work and environment. Alternatively, administrators could develop an intentional onboarding curriculum that is campus-focused while recognizing the varied work and needs of librarians.

It is important to note that the study discussed in this paper was conducted across the U.S. and relates to the preparation and early career experiences of EC-12 school librarians and the findings or conclusions drawn may not be generalizable to other geographic locations. There are opportunities for future research, including conducting similar studies in other geographic locales and focusing on the experiences of mid- and late-career school librarians and other librarian disciplines and environments.

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Correlation Between Film Criticism, Social Issues and Student Audience Reception

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Abstract. The aim and purpose of this paper, focused on media and information literacy, is to define today's role and need for criticism, establish the correlation between film criticism, social issues in films, and student audience reception, and define how books and university lectures affect this process. We consulted the works of renowned researchers in these fields. We established a research model using Croatia as a case study, with three in-depth interviews with university professors, and a questionnaire answered by 338 students of social sciences and humanities in six universities, in order to understand how students' media literacy is influenced by film reviews, books and lectures. We found out how often they read film reviews and where, and the way the reviews, social issues and film courses affect their decision to watch a film and their opinions about it. We also determined which books influenced their film choices and reception.

Keywords: Media literacy · information literacy · film criticism · social issues · film books · film education

1 Introduction

Film has adapted itself to the new technologies of the 21st century: we can still watch movies in cinemas and festivals (which survived the lockdown period of the pandemic), we can watch more films than ever using various streaming platforms, we can watch them on our tv-sets which are getting bigger and bigger, on our apartment walls using home projectors that are constantly improving their picture quality, or we can watch them like many students do: on their laptops, tablets or even on mobile phones during long train or bus rides to their universities or home towns.

Film is a contemporary component of mass media, and in the context of information and communication sciences, we should emphasize that the basis of a film work is its informational and communicative role. Therefore, as a medium of mass communication, film can be included in various forms of the communication process. Film should also be viewed from the perspective of its role as an interpreter of the socio-cultural reality from which it grows and with which it inevitably achieves a specific type of dialogue [1, p. 5].

But what is the role of criticism today, and how relevant it is in the era when everybody can publish their reviews online on personal web pages, social networks or video blogs?

Is film criticism (or, broadly, cultural criticism) an element of media (film) literacy? Is the role of film criticism to upgrade the film literacy of the audience? We will try to answer these questions in the continuation of this paper.

2   Role of the Critic in the 21st Century

"A critic must not have any prejudice – political, ideological, ethical, or aesthetic, and must possess independence, neutrality, power of comparison, concentration on details and remain outside of all the usual publicity campaigns, lobbyist claims, and marketing tricks of the producers", stated Anatolij Kudrjavcev [2, p. 302].

In the world of interactive technology, the role of the critic is increasingly important and valuable, and criticism becomes practically a subversive political act, opposing the consumerist approach to culture and resisting the monetization logic of the cultural market, wrote Ryan Gillespie [3, p. 72]. Criticism gives way to user reviews in the spirit of democracy and the consumer mentality of user reviews encourages the treatment of art and entertainment as mere pleasure, thus eliminating respect and consideration of challenging, experimental, and avant-garde works [3, p. 66].

Most serious art critics know a great deal about the field they cover and can evaluate a particular work based on years of serious study and experience, and were vetted by their employers, noted Michael Kaiser [4]. Anyone can write a blog or leave a user review, but just because someone writes about art does not mean they have professional judgment. Great art should not be judged by a popularity contest, otherwise, art that meets the taste of the widest audience will always be considered the best [4].

Daniel Mendelsohn [5] presented the equation "knowledge + taste = significant, meaningful judgment" as the essence of cultural criticism, arguing that not everyone can be a critic because very few people have the rare combination of qualities that make a good critic. Good criticism, in his view, involves the ability to intelligently and stylishly mediate between a work and its audience; to educate and enlighten the reader [5].

Norwegian researchers Jan Fredrik Hovden and Karl Knapskog [6, p. 791] made a distinction between professional critics and culture journalists who are more anti-elite and populist in their view of culture and support the idea of culture as a private realm of leisure which should be more strongly driven by economic interests.

The interconnected processes of commercialisation, professionalisation, digitalisation, and globalisation have expanded and revitalized journalism in culture in society, wrote Danish theorists Nete Nørgaard Kristensen and Unni From [7, p. 768]. Today it includes economic analyses of cultural industries and discussions of the social impact of contemporary media culture, while the media assigns the role of the cultural critic to various experts, media professionals and celebrities from the cultural scene [7, p. 768].

Swedish theoreticians Kristina Riegert, Anna Roosvall, and Andreas Widholm [8] came to the conclusion that the representation of journalism in culture is growing, and the boundaries in relation to other types of journalism are becoming increasingly porous as more and more general practice journalists are writing about culture.

In a later study, Kristensen [9] stated that although interviews and analyses have become more and more present in journalism in culture, this has not led to a decrease in the number of critical reviews or a radical weakening of critical discourse. Also, she

wrote that critical intellectual discourses in newspaper reviews played a significant role in legitimizing new cultural subfields such as popular music or television series, and turning them from entertainment into art.

3 The Need for Film Criticism Today and Its Correlation with Social Issues and Audience Media Literacy

In modern times, discussions about film criticism in the world are mainly reduced to a few questions: should evaluation be a function or the main goal of film criticism, what should be the relationship between critics and the audience, in what way have new media changed film criticism, and the effects of the greater democratization of the media.

Indicating which films have aesthetic value is still crucial today because the absence of critical evaluation would lead to general relativization, concluded Rónán McDonald [10, p. 134]. He points out that the development of cultural studies has contributed to the fact that film is evaluated less aesthetically in academic circles [9, p. 134].

The primary role of critic is not to describe films, demystifying hidden meanings or latent ideologies, but to evaluate the artistic aspects of the film, without neglecting the interpretation and contextualization, wrote Noël Carroll [11, pp. 16–18].

Christian Keathley [12, p. 180] emphasized the new form of criticism, video essays, that allow completely new possibilities and presentation of impressions to film critics.

Mattias Frey [13, p. 12] nominated authority as the main advantage of a critic. Although film criticism on the internet is more democratic than in traditional media, such as radio and television compared to older media, the mentioned change in democratization is not as radical as it seems at first glance [13, p. 127].

The basic characteristic of daily newspaper film criticism is drawing conclusions in connection with broader social, political, and cultural issue, as pointed out by the Croatian theorist Iva Rosanda Žigo [14, p. 108]. Research of daily film reviews in the period from 2001 to 2019, in which Croatia was a case study, has confirmed the mentioned theory and determined that there was a higher level of affirmative criticism towards films that indicated current social problems [15].

Film criticism has the ability to stimulate the communication process and then develop it further through different channels and forms of communication, whereby criticism actually significantly influences the further expansion of the reception role of the film in the wider socio-cultural ambient. It does not only convey the story of a film, it does not have to refer exclusively to directorial, dramaturgical, and stylistic specificities, but also brings a broader context that transmits to the viewer [1, p. 6].

Film criticism has also become the most present form of newspaper criticism, it does not contribute to the decline of serious journalism in culture and reaffirms film as an important art, proved Annemarie Kersten and Susanne Janssen [16].

Eliashberg and Shugan [17, p. 77] empirically proved that critical reviews correlate with late and cumulative box office receipts but do not have a significant correlation with early box office receipts. This finding suggests that critics, at least from an aggregate-level perspective, appear to act more as leading indicators than as opinion leaders.

Eagan [18] proved the influence of contemporary film reviews, especially negative ones. His findings show that film critics have a moderate influence on wide releases and

a weak influence on limited releases based on reviews from critic aggregators. Also, negative reviews had more of an impact than positive reviews on both types of movies, and this moderate influence could have a significant impact on box office revenue.

4 Film Criticism and Student Audience Reception and Literacy

Students in the 21st century all over the world are "swimming in an ever-changing world of media, technology, and popular culture", as Hobbs noted in her book [19, p. 8]. Social networking, music, and movies are their key pleasures and there is "so much entertainment and information competing for our attention at all times, and the scarce resource is human attention. In the age of information overload, learning to allocate one's attention to high-value messages is the most important skill that will continue to reap benefits" [19, p. 8]. Head and Eisenberg [20, p. 1] in their research on student information literacy and connecting culture and lectures found out that students conceptualize research and seeking information, as a "competency learned by rote, rather than as an opportunity to learn, develop, or expand upon an information-gathering strategy which leverages the wide range of resources available to them in the digital age".

In today's world, information literacy is essential for survival and success; if left unchecked, the social consequences of information illiteracy will continue to grow more dire, thus its study must be at the core of every education, warn Taylor and Jaeger [21].

The main objective of our research was to define the correlation between film criticism, social issues in films, and student audience reception, and how media and information literacy affect this process. In order to find answers to the research questions, and to understand how students' media literacy is influenced by film reviews, books and lectures, we used Croatia as a case study and conducted a survey at six Croatian universities of humanities and social sciences.

4.1 Methodology of the Case Study

In this case study quantitative-qualitative research was used as the main method. A Google Form questionnaire was used to question 338 students in six Croatian universities. We found out how many of them read film reviews and where (printed media, review aggregators, web portals, radio, video blogs, social networks), and the way the film reviews and different social issues in the films affect their decision to watch a film and their opinion about it. We determined which film books they read and which university film courses affected their film choice and reception of films.

Qualitative research methods were also used, with in-depth interviews with three university professors, in order to see how they present the importance of film criticism to students, what social issues in films they discuss with students, how the students react to film reviews, and to films that deal with different social issues in their discussions on classes and in written papers.

4.2 Results of the Quantitative-Qualitative Research

The average age of students participating in the survey was 21. 75.1% of the students were female, and 25% were male. The participating six universities were: University

of Zagreb (Faculty of Humanities and Social Sciences, Academy of Dramatic Arts, Faculty of Croatian Studies), Catholic University of Croatia, University of Rijeka (Faculty of Humanities and Social Sciences), University of Split (Arts Academy, Faculty of Humanities and Social Sciences), University of Osijek (Faculty of Humanities and Social Sciences) and University North.

As a first question, we asked them if they follow film reviews, on a scale from 1 (never) to 5 (very often), and 9.5% replied with 1, 34% with 2, 32.5% with 3, 17.2% with 4 and 6.8% with 5 (very often). The average result was 2.77 (Fig. 1).
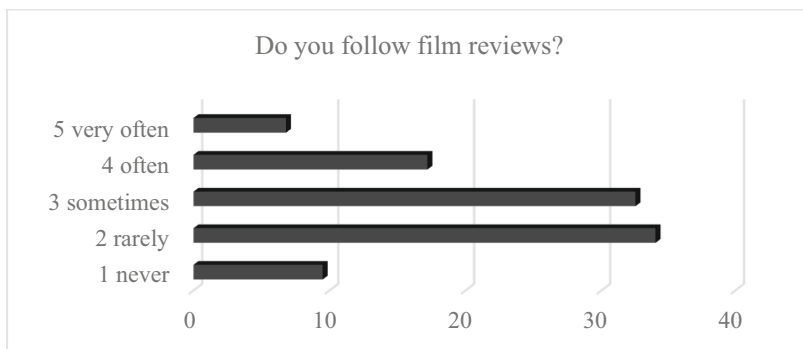
Fig. 1. Students' answers on the frequency of following film reviews

We also asked how much do reviews influence their choice of film, on a scale from 1 (not at all) to 5 (strongly). Most of them, 38.2% replied with 3 (moderately), 33.7% with 4 (considerably), 12.4% with 2 (slightly), 10.1% with 1 (not at all), and 5.6% with 5 (strongly). The average result was 3.12 (Fig. 2).
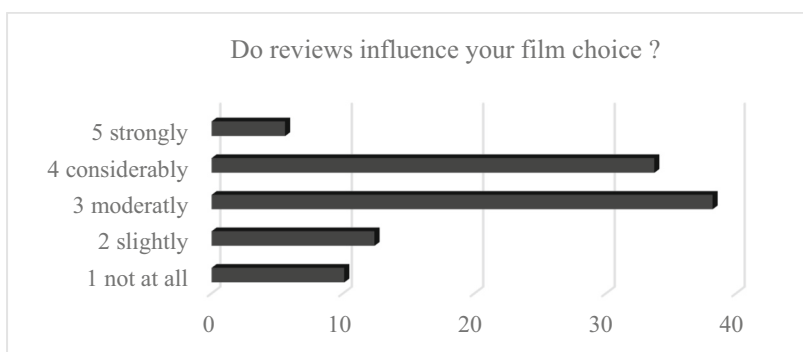
Fig. 2. Students' answers on how the reviews influence their choice of films

When asked how much reviews affect their opinion of the quality of the film, on a scale from 1 (not at all) to 5 (strongly), most of them, 34.6% replied with 3 (moderately),

25.7% with 2 (slightly), 24.3% with 4 (considerably), 12.4% with 1 (not at all), and 3% with 5 (strongly). The average result was 2.79 (Fig. 3).
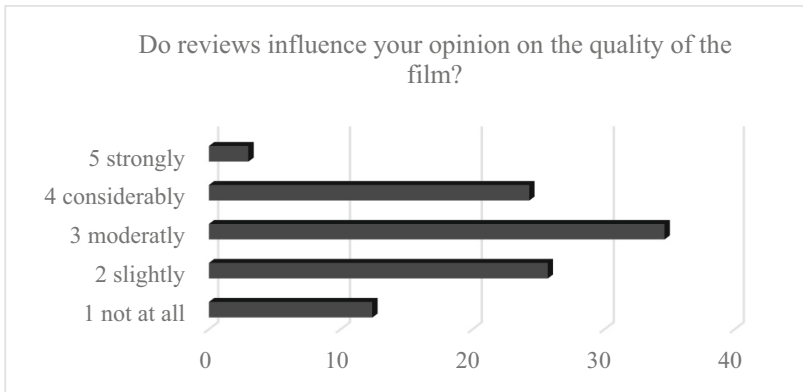
Fig. 3. Students' answers on how the reviews influence opinion on the quality of the film

When we asked them where they follow reviews (multiple answers were allowed), most of them (62.1%) replied that they follow them on social networks, 44.4% replied on review aggregators (Metacritic, Rotten Tomatoes), 42% on portals, 38.8% on video blogs, 28.1% on online editions of printed newspapers, 8.8% in the printed newspapers and 4.7% on the radio, while 11.2% use other sources to find out about the quality of films (such as word of mouth recommendations) (Fig. 4).
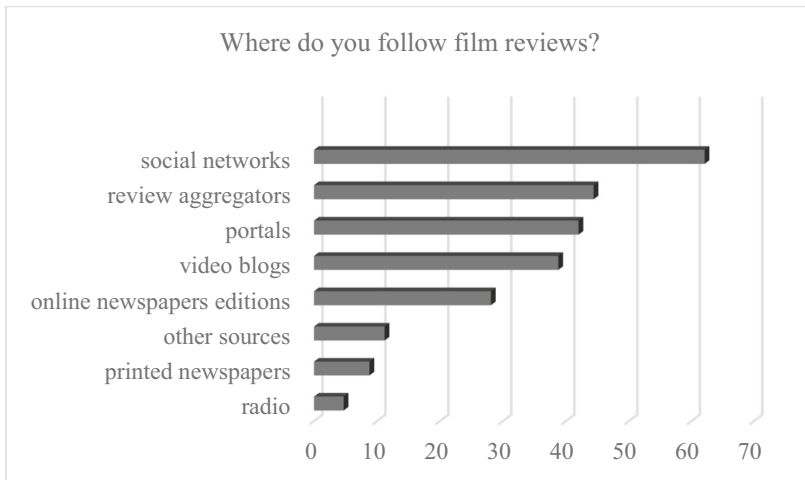
Fig. 4. Students answers on the media where they follow film reviews

We also asked them what current social issues that the film deals with influence their choice of film and their attitude towards the film (multiple answers were allowed).

Most of them replied human rights and freedoms (50.3%), which is followed by films with no social issues (42.6%), then violence, defence, and security (38.2%), gender equality (31.7%), ethics and religion (28.7%), politics (26.3%), health (18%), other topics (14.5%), finances (14.2%), ecology (12.1%) (Fig. 5).
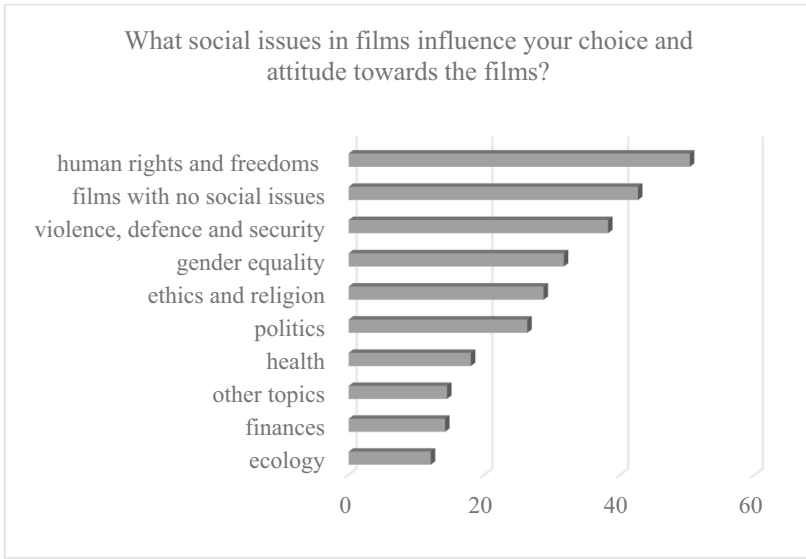
Fig. 5. Students' answers on what current social issues that the film deals with influence their choice of film and their attitude towards the film

We asked them to what extent the current social issues that the film deals with influence their choice of film and their attitude towards the film (Fig. 6).
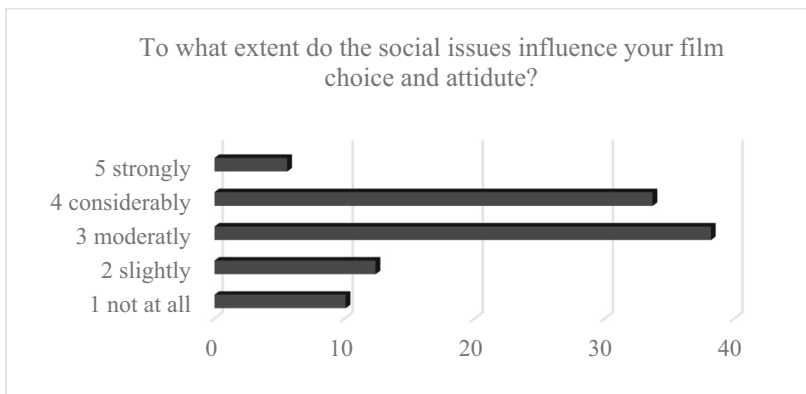
Fig. 6. Students' answers on what extent do the current social issues that the film deals with influence their choice of film and their attitude towards the film

On a scale from 1 (not at all) to 5 (strongly), their replies were: 30.2% replied with 3 (moderately), 27.5% with 4 (considerably), 18.9% with 2 (slightly), 16.6% with 1 (not at all) and 6.8% with 5 (strongly). The average result was 2.89.

We asked them to list the books that have influenced their decisions about choosing movies to watch. One hundred fourteen out of 338 replied with titles. Most answers (109) were fiction books, while five books were books on cinema. *Lord of the Rings* was mentioned 13 times, *Harry Potter* 11 times, followed by *Pride and Prejudice* (four times), while other fiction books were mentioned twice or once.

We also asked them to list the film books that have influenced their opinions about movies and their film taste. Twelve film books were mentioned, no book was mentioned twice, and among film books were: *The Great Movies* by Roger Ebert, *Film* by Ronald Bergan, and three film books by Croatian film scholar Ante Peterlić (*Film history, Film theory* and *Studies on 9 films*).

Finally, we asked the students to what extent did the film lectures they attended influence the choice of films they watch and their attitude towards these films. On a scale from 1 (not at all) to 5 (strongly), their replies were: 30.8% replied with 1 (not at all), 21.3% replied with 3 (moderately), 20.7% with 4 (considerably), 16% with 2 (slightly), and 10.9% with 5 (strongly). The average result is 2.64 (Fig. 7).
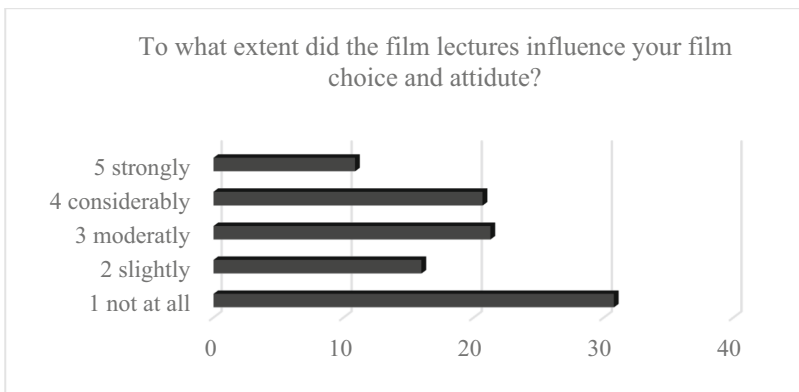

Fig. 7. Students' answers on what extent did the film lectures they attended influence the choice of films they watch and their attitude towards these films

4.3   In-Depth Interviews with Film Professors

We conducted three in-depth interviews with university professors at the universities of humanities and social sciences taking part in this research, in order to see how they present the importance of film criticism to students, what social issues in films they discuss with students, how the students react to film reviews, and to films that deal with different social issues in their discussions on classes and in written papers.

In this chapter, we present the most important findings from their replies. The professors we interviewed were Iva Rosanda Žigo, University North, Koprivnica; Dejan Durić, University of Rijeka and Marijan Krivak, University of Osijek.

First, we asked how they present the importance of film criticism to students. Iva Rosanda Žigo teaches the course Critical Analysis and academic writing, where she introduces journalism students to literary criticism, theatre criticism, and film criticism. Considering that for today's generations, in the context of these three media, film is still the closest, favourite, and often the most understandable medium – students regularly respond best and show the greatest interest in film criticism, because of film's visual component, brevity (compared to literature and theatre), and the convenience of watching. Apart from the fact that, as is the case with art criticism in general, it is important to know the basic terms in the field of filmology, students need to point out the parallels that can be drawn between the film and everyday social life. She believes that this dialogue with reality, which the film establishes, is the most important characteristic of film criticism. Seen in this way, the film is always in the position of an analyst of society and various social problems, which makes it easier for students to think about this medium, and opens the way for them to critically reflect on what they saw.

Students in Dean Durić's course are given several different film reviews to read so that different types of film reviews are covered. Then they work on the texts: they analyse the component parts and structure of the reviews, as well as different ways of argumentation, and evaluate how successfully it was written. Durić believes that the importance of film criticism primarily rests on the development of film culture.

The question of film criticism is part, but not at the center of Marijan Krivak's course focused to philosophy and film. His students are drawn into the competitiveness system exclusively on the metric level of ECTS points and they do not read anything beyond what is given there (if even that much). Criticism is a demanding job, as is an opinion, and it is certainly not an effort that would be in fashion today, says Krivak.

We then asked the professors what social issues in films they discuss with students in their discussions on classes and in written papers.

The discussion very often depends on some current social event, characteristic of the moment in which the course takes place, replied Rosanda Žigo. Given that we are talking about journalism students, she thinks it is important that students learn to react quickly and that they can argue their conclusions with concrete examples. In this sense, they discuss, for example, violence, corruption, and politics. Equally, they very often touch on some timeless topics that are always in some way present as a problem in society, for example, the problem of male-female relations; feminist themes, the status of LGBT individuals in society, and religion.

Social issues that are discussed are related to economic issues, human rights, gender issues, and vulnerable social groups, but also the way in which a film work represents reality, can have an ideological role, in creating stereotypes, or even propaganda, and what strategies are used in these purposes it serves, said Durić.

Krivak tried to thematize some philosophic themes such as truth, justice, morality, but mostly about the political achievements of certain classics, as well as Croatian films of recent production.

We then asked how the students react to film reviews. Rosanda Žigo always devotes one to two blocks of lectures to the analysis of published film criticism. For this purpose, she chooses an example of amateur criticism, an example of criticism in a daily newspaper (newspaper criticism), and an example of professional criticism (essay criticism).

The first example is often immediately rejected as insufficiently developed and full of weaknesses. The discussion about criticism in the form of an essay can sometimes be extremely interesting. On the one hand, students show a kind of discomfort, so they hesitate to oppose authority, and on the other hand, they find this type of criticism, which is understandable, too demanding, and insufficiently understandable. But, by encouraging discussion and analysing this criticism in detail, they often show an exceptional capacity for critical reflection, so this type of criticism proves to be useful precisely in the context of the discussion and deeper consideration of the role and significance of film criticism for the understanding of film production. However, given that newspaper criticism is the closest to them because they read it most often on their own, they still show the best results in the discussion with this genre. They mostly work on this type of criticism in the context of the task of writing a film review independently.

Students generally react positively to film criticism and are ready to try their hand at writing, says Durić. For them, film criticism primarily has the function of directing viewing in the sense that it facilitates the selection from the multitude of titles offered. However, it should be emphasized that they point out that positive or negative criticism is not necessarily a condition of whether or not they will watch the film, so it partly has an informative role. On the other hand, they understand the importance of film criticism for the development of film culture and the education of the audience.

Krivak says that his students do not really consider written reviews of individual films (neither printed nor from various portals) too important. Closer to them is the conversational argumentation that he practices in his film philosophy course. So, they quite well capture the psychoanalytic moments in Hitchcock films, but also in Fincher's *Fight Club*, for example. However, given their moderate literacy, their ability to articulate their position is limited.

Finally, we wanted to find out how the students react to films that deal with different social issues in classes and in written papers. Sometimes students react surprisingly conservatively to certain social problems, or rather to the way they are portrayed in films, says Rosanda Žigo. We would think that younger generations have fewer problems with the reception of explicit scenes, such as violence or sexual relations, but often the opposite is true. When they discuss films that portray a social problem in an explicit, often painful way, they very clearly and sharply represent their position in the conversation. However, in written essays and reviews, they show some restraint. Although she encourages them to express their own, well-argued position, which may be completely opposite to the position of a well-known film critic, it is difficult to fully assess whether the students fear that they will be graded lower because of this; or yet (at that level of education) they still do not have sufficient theoretical, filmological and journalistic tools. Or, maybe the truth is both.

Durić replies that his students respond well to films that consider a certain social issue. The impression is that it is easier for them to discuss social issues in films than about the formal aspect of the work and film language, because that requires more knowledge and practice.

Students read very little printed media, or not at all, and dialogue (polylogue) works best in the classroom, says Krivak. However, recognizing the real socio-political context

is still quite far from them. Krivak adds that in every generation there is someone who takes a deeper interest, usually two out of a group of 30 course students.

5   Discussion and Conclusions

The aim and purpose of this paper was to define today's role and need for criticism, establish the correlation between film criticism, social issues in films and student audience reception, and define how books and university lectures affect this process.

After consulting and analysing the most relevant works of renowned researchers in these fields, the conclusion that can be drawn is that art criticism should be supported and protected as the last barrier opposing the growing consumerist approach to culture. Also, in the abundance of amateur reviews on the Internet, readers still value the reviews of renowned and experienced film critics from prestigious daily newspapers and magazines, which are available to a wider range of readers through publications on newspaper websites and social network pages, especially important for the younger generations of readers. Furthermore, digitalization and democratization have not led to a decline in the importance of film critics, because in the abundance of audio-visual content, the viewer needs a quality guide and recommendation for choosing the best one, and this can be provided precisely by film criticism. By adapting to new media, film criticism found its place in the digital age, and daily newspaper film criticism still has the greatest influence for the general audience due to the continuous professional involvement of the best critics and the reputation of the daily newspapers. We determined that cultural criticism is an important element of media literacy, and that film criticism role to upgrade film literacy of the audience is still very relevant.

This study shows how different aspects of media and information literacy affect the ways in which today's students of humanities and social sciences choose and evaluate films. The quantitative-qualitative research showed that students of humanities and social sciences sometimes follow film reviews, but when they do, the reviews moderately influence their film choice, more than their opinion on the quality of those films. They prefer following reviews on social networks, review aggregators, portals, and video blogs rather than in printed newspapers and on the radio. Social issues that the film deals with moderately influence their choice of film and their attitude towards the film, slightly more than film lectures. They are more interested in human rights and freedoms, violence, defence, and security, moderately in gender equality, ethics, religion and politics, and less in health, finance, and ecology as social issues in the movies. The books that influence their film choice are predominantly fiction literature, rarely books on cinema (scientific literature).

In-depth interviews with university professors have shown that they try to present the importance of film criticism to film students, but the students prefer and are more open to discussing films then writing about them. The professors discuss various social issues with students (mostly gender issues, politics, and human rights) and notice that students like to speak more about social issues than about the artistic aspects of films. Overall results have shown a mediocre level of media and information literacy.

On the basis of this research an evaluation model is established, applicable to other countries, that could have a wider impact on research at universities, and could also be

applied to theatrical and literary criticism. Therefore, we believe that this research gave relevant scientific results, and will inspire new studies in mentioned similar contexts and give valuable input to a better understanding of media and information literacy.

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Information Literacy Practices of Hospital Librarians in an Era of Evidence-Based Medicine

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Abstract. Demands for an evidence-based healthcare increase and today all medical decisions are to be based on scientific results. The evidence-based healthcare means that hospital librarians have a stronger role as mediators of scientific information. The evidence-based movement implies a positivistic epistemological view that influences the information literacy practices. This study focuses how the information literacy practices of hospital librarians in Sweden are constructed and enacted in relation to different epistemological perspectives in healthcare. The analysis is structured around three identified practices of hospital librarians where information work is performed: the clinical practices, the information seeking practices and the health technology assessment (HTA)-practice. In these practices, different epistemological perspectives are present, which affects the information literacy practices of hospital librarians. There is a movement from the holistic knowledge connected to the clinical practices, via specialized knowledge and generic instructions in the information seeking practices, to the most specialized knowledge and positivistic perspective in the HTA-practice.

Keywords: Information literacy · hospital librarians · hospital libraries · healthcare · evidence-based medicine · epistemological perspectives

1 Introduction

In today's healthcare there is a strong focus on evidence-based scientific information. The evidence-based movement states that healthcare should be based on scientific research. In all parts of healthcare, on policy, administrative and clinical levels, decisions should be grounded on results from scientific research [1]. Hospital librarians have a role as key actors when it comes to facilitating information seeking and use of scientific evidence within healthcare [2, 3]. This paper is part of an ongoing project on hospital librarians where different parts of their professional practices are analyzed. Since the 2000's, socio-cultural perspectives on information literacy are common in Scandinavian programs in library and information science (LIS), and natural scientific perspectives are quite unfamiliar to most new librarians. The increasing demands for an evidence-based healthcare affect the information practices of hospital librarians, and hospital librarians

need to consider the influences of positivistic epistemological views on information literacy. This study focuses on information literacy practices of hospital librarians and the interaction of different epistemological perspectives affecting the information literacy practices.

In recent years, with demands for evidence-based practice, the main role of hospital libraries has gradually shifted from serving patients with literature to becoming medical libraries for healthcare professionals. This change has transformed the role of hospital librarians into specialists focused on clinical librarianship and research support. Hospital librarians today are often associated with the systematic seeking of scientific information within the context of health technology assessment (HTA) [4]. HTA is a way of working to implement the use of evidence in healthcare focusing on both clinical and administrative issues in systematic reviews with the purpose of finding the highest level of evidence. The evidence-based movement in healthcare is recognized as a response to the demands that all healthcare should be based on research results and that all decisions should be controlled and evaluated systematically. Thus, the evidence-based movement takes its departure from a natural science perspective based on quantitative studies [cf. 5].

Healthcare is constituted by informative practices where information plays an important role in the context of finding the best treatment or diagnose patients. For healthcare professionals there is a need for specialized information literacy, and information literacy in healthcare is arguably best understood as situated practices and by epistemic, social, and corporeal information sources where collective aspects are emphasized [6]. Hospital librarians must represent a broad view of information literacy since they need to be able to serve healthcare staff in different areas with different practices.

The aim of this study is to explore the information literacy enacted and developed by hospital librarians as they work to support evidence-based practice. The three main research questions guiding this investigation are:

- What is the nature of information literacy practices constructed, negotiated, and enacted by hospital librarians as part of their information work?
- How are the information literacy practices of hospital librarians created in interaction with healthcare professionals?
- How can information literacy practices of hospital librarians be understood from an epistemological point of view?

The first and the second questions are addressed in the results section and the third is discussed in the discussion section.

2   Information Literacy – Epistemological Foundations

Kapitzke [7] critiques the positivist epistemology underpinning information literacy practices, and much library practice in general. Ever since its inception in 1974, information literacy as a concept and a practice employed in library and educational settings has been shaped by a positivist philosophical orientation. While this also holds true for libraries who have historically been carriers of the rationalistic Enlightenment tradition, Kapitzke specifically critiques the universalist and cognitive conceptualization of information as something neutral used for learning through problem solving. From this

cognitive orientation, information literacy has generally been envisioned as attitudes and skills inside individual learner's heads, and discursively in policy writing, information literacy has been connected to notions of life-long learning and economic growth. From a poststructuralist perspective Kapitzke instead argues that "there is no space outside of language, politics, and ideology" [7, p. 49]. This position calls for attention to the cultural context of information and knowledge and the surrounding power relations.

The situated nature of information, and information literacy, is brought to the fore in much LIS-research during the past decades. Limberg, Sundin and Talja [8] outline three theoretical perspectives on information literacy particularly strong in Nordic LIS-research: phenomenographical, sociocultural and discourse analytical. Arguably, the sociocultural view (including subsequent sociomaterial research) has become the dominating perspective in the Scandinavian countries and the main paradigm informing how information literacy is taught and discussed at LIS-programs. This development reflects a theoretical turn towards practices, or in other words, a socio-cognitive turn [see 9] where information literacy increasingly is understood as a situated practice. In this tradition, socioculturally oriented LIS-researchers within a Scandinavian tradition have studied information literacy as context dependent and tool-based in settings such as primary school [10], lower secondary school [11], upper secondary school [e.g. 12], teacher training [13], social networking sites [14], and midwifery counselling [15]. Conceptually, Hicks [16] explores the concept transition and its role for information literacy, and several recent studies discuss challenges for information literacy in digital culture shaped and mediated by algorithms [17, 18].

In summary, information literacy has historically been underpinned by a positivist epistemology, but in the Scandinavian tradition, research and education within LIS has been strongly influenced by the socio-cognitive turn and the sociocultural perspective. Swedish librarians are consequently trained to understand information literacy as a situated practice. We now turn to how information literacy is practiced and understood in hospital libraries.

3   Information Literacy in the Context of Hospital Libraries

In a review of how hospital librarians have provided information literacy instruction for health science students and clinicians information literacy is framed as a cornerstone of critical evaluation of health science research and evidence-based practice (EBP) [19]. In this (American) setting, information literacy is blended with evidence-based practice where the systematic review of evidence according to strict criteria is focused, and information literacy instruction is centered around finding, evaluating, and using information in clinical settings (for specific purposes). Consequently, hospital librarians are invested in providing "EBP information literacy instruction" [19, p. 21], and librarians are essential for supporting an "evidence-based culture" within their organizations [20]. Hospital librarians are also identified as important for EBP since it is an information-intensive activity where information literacy skills are highly valuable [21].

EBP, or evidence-based medicine (EBM), share historical roots with the notion of information literacy, and both concepts are thought to answer the challenges from the sharp increase in electronic and scientific information from the 1970s and onwards. It

is therefore not surprising that information literacy principles (identifying information needs, searching, evaluating, applying) served as the instructional model for EBM when it was gaining momentum in the 1980s [22]. While EBM represents a strong paradigm within contemporary healthcare, critical voices have also been raised concerning deficiencies when it comes to individualized care and use of evidence other than clinical research (such as narrative evidence) [22]. The importance of individual care and the recognition of other types of scientific evidence than clinical research is commonly observed in discourses from nursing. Previous research shows how information practices in healthcare connect to both a science-oriented medical discourse (EBM) and a holistically oriented nursing discourse [23], and that information literacy practices of hospital librarians need to balance between an understanding of information literacy as either generic or embedded [5].

4   Information Literacy as Situated Practices in EBM

In this paper we regard information literacy as a social and situated practice [24]. In light of this starting point this paper also highlights the collective aspects of information literacy where information literacy is performed and constructed through teamwork at the workplace [25]. To view information literacy as a collective practice is closely connected to a focus on the negotiation of information literacy based in accepted and legitimized knowledge and ways of knowing in the context of EBM. However, conflicting points of view contribute to friction between different ways of knowing and different perspectives on knowledge, exemplified by the conflict between the holistic and caring knowledge of nursing and the science-oriented knowledge of EBM [23]. In this study, we focus on the tension between different epistemological understandings of the nature of scientific evidence contributing to opposing views on information literacy and how hospital librarians navigate between these views that include generic and situated understandings of information literacy.

To understand information literacy as a situated practice implies that information literacy practices are connected to different practices of hospital librarians. The information practices of hospital librarians are often invisible to healthcare professionals, although hospital librarians are experts on scientific information and research support [26]. The notion of information work, understood as a secondary activity supporting the primary activity [27], contribute to the visualization of hospital librarians' information practices, focusing on the resources and activities employed to seek and find information [28]. With the perspective of information work three main hospital library practices have been identified in previous research: clinical practices, information seeking practices, and an HTA-practice [26]. Lloyd [25] frames information literacy practices, such as facilitating access to information, as critical for solving workplace problems and consequently as a critical practice of information work. Therefore, we understand information literacy as situated in the three hospital library practices.

5   Method and Material

This study collects empirical material from three different studies on hospital libraries and hospital librarians in an ongoing project started in 2020. The material includes 20 semi-structured interviews conducted with hospital librarians and hospital library managers between 2020 and 2022, and four observations conducted at two different hospital libraries, including a search introduction, two search instructions, and an HTA-meeting. The observations focused on interactions with healthcare staff and how librarians acted in their professional roles. During the interviews we asked for example about user groups and services, challenges in the organization, as well as future development areas. The empirical material was collected in five different regional municipalities in Sweden. In Sweden, there is at least one hospital library in each region. The interviews lasted for about one hour each, and they were conducted either at the hospital library, or via a digital tool for video conferencing. The observations were between half an hour and two hours, and were conducted at the hospital library, or at the hospital. In Table 1, an overview of the empirical material is presented.

Table 1. Overview of empirical material

Regions	Interviews	Observations
A	5	3
B	5	3
C	6	1
D	2	–
E	2	–

The material was analyzed with a focus on how information literacy practices are constructed and enacted by hospital librarians in the context of healthcare. During the analysis there was a continuous interaction between the material and the theoretical perspective where information literacy is regarded as social and situated practices. The theoretical perspective implied a focus on social and collective aspects in the construction of information literacy. In the material, we searched for expressions of how information literacy is constructed and performed by hospital librarians in different contexts, in interaction with healthcare staff. It was evident in the analysis process that the performance of information literacy was closely connected to the identified practices of hospital librarians where information work is performed [26]: clinical practices, information seeking practices and an HTA-practice. The following analysis was structured by the identified practices.

6   Results and Analysis: Information Literacy in EBM

This section is structured according to the identified practices of hospital librarians where either visible or invisible information work are included: clinical practices, information seeking practices and an HTA-practice. We focus on the collective construction of information literacy practices of hospital librarians when they interact with healthcare professionals. In the following, illustrative and representative examples are presented for each identified practice. Together, the practices constitute an arena for information literacy practices and are of similar importance to the professional role of hospital librarians.

6.1   Information Literacy in the Clinical Practices

Clinical practices are represented by the closely connected collaboration between hospital librarians and healthcare staff. Hospital librarians make efforts to reach out and be involved together with healthcare staff in clinical practices. In the clinical practices hospital librarians strive for participation in the clinical work, for example as clinical librarians who work in teams with physicians and nurses or being available at the clinical training center ready to pick up questions from healthcare staff. Therefore, information literacy practices characterized by clinical practices could be described by the close connection to healthcare and could be defined by librarians picking up questions from healthcare staff without them asking.

Hospital libraries are often part of the research department within the healthcare organization in the region. At one of the hospital libraries the librarians are present at the research department once a month to come across questions the researchers and specialized clinicians might have. It is also an opportunity for the librarians to learn about the work and research conducted in the region. There "are spontaneously asked questions when we're present. Seize the opportunity, now the library's here, run past and check how you could twist your PubMed search or something" (A:2 20200204).

Part of the information literacy practices is the librarians' communication with healthcare staff, mainly to reach out and spread knowledge about how the hospital library can help:

"We've … tried to get out on workplace meetings, and in periods we've done some of these campaigns, to try to reach out and … started up lunch lectures for staff … [One of the librarians] have sent out to <u>all</u>, mail to all nurses or maybe all occupational therapists … Just to try to show … that we exist." (C:3 20200219)

To reach out to the healthcare staff the librarians try to communicate generic recommendations about how the hospital library may support healthcare staff, with the aim of being more involved in the clinical practices.

The main goal for hospital librarians is to be involved as a natural part in the clinical practices to get access to the everyday work of healthcare staff and to be a legitimate work partner. One of the librarians reports annual visits to the children's clinic to discuss issues of interest to the clinicians (B:3 20200213). In the parent organizations there is a certain insecurity about the librarians' competence and how they can support healthcare, and therefore the dialogue between the library and healthcare is made easier if the librarians

have a background in healthcare (A:3 20200130). One of the library managers with a background in different parts of the healthcare organization describes that there is:

"also, a kind of situational awareness, in other words they describe problems, or they describe other specific situations which I easily could understand due to my background in several places … [and] that we take advantage of each other's knowledge and knowledge areas." (A:3 20200130)

Healthcare is traditionally hierarchical and therefore hospital librarians often face challenges when interacting with healthcare staff. Clinicians are generally hesitant to share their discussions with external partners and to include librarians in their discussions (A:3 20200130).

6.2 Information Literacy in the Information Seeking Practices

The information seeking practices are characterized by the hospital librarians' pedagogical role performed in terms of search support for healthcare staff. Hospital librarians offer search instructions as well as search introductions where hospital librarians collaborate with healthcare staff to support their work in the most efficient way. Hospital librarians are also involved in evaluating information together with healthcare staff, even though the evaluation of sources require specified scientific knowledge. Included in the mediating role in the information seeking practices is also research support in the area of medical research.

Information literacy practices connected to the information seeking practices are shaped in interaction with healthcare staff during search instructions and search introductions. Usually, the librarians conduct the search instructions in collaboration with healthcare staff, instructing and supporting their searches as they go, with the overarching goal to support healthcare staff for them to save time (A:2 20200204). Since search instructions include search assignments from healthcare staff the information seeking practices are characterized by a set of generic competencies of hospital librarians. Sometimes there is a need for specific knowledge and therefore interaction between the librarian and the staff:

"[they want] a search instruction and on the one hand I might get an e-mail with the information they need, and then we help each other… or I help them and then I send them [the search results] and we discuss back and forth, or that I meet somebody and then we help each other… yes, like an ordinary search instruction, … but it is fully directed towards medicine." (B:3 20200213)

Search instructions often requires specialized knowledge from clinicians, notably when aspiring specialist doctors are working on their specialist training. Hence, search questions from clinicians are more specific (A:3 20200317 observation). The librarians usually work together with search instructions to develop their searches and to bring in each other's knowledge. Thus, the information literacy practices are made up mostly of generic competencies in the collaboration between librarians. Search instructions therefore signal a generic depiction of information literacy among healthcare staff.

6.3   Information Literacy in the HTA-Practice

HTA is a certain way of working to find the best possible evidence for a treatment, or a diagnosis. Since healthcare nowadays has demands for being evidence-based, HTA is of growing importance for hospital librarians who often are part of the HTA-team working together with healthcare professionals such as physicians, psychologists, and medical doctors [4]. The HTA-process therefore illustrates the encounter between a very specific information literacy practice carried out by healthcare professionals and researchers, and a more generic, yet specialized competence performed by librarians.

All HTA-work is defined by strict guidelines following and upholding the entire work process, as well as the included search process. The information literacy practices associated with the HTA-practice are characterized by a systematic view on information seeking and information literacy (C:2 20200212). Within the context of HTA, all searches are carefully documented by the librarians from the beginning of the search process to the end. Since what distinguishes HTA-work is the systematic way of working and evaluation of scientific research to reach an understanding of best practice, the whole search process is visible in the finished product, the HTA-report:

> "It's very carefully documented – it should be transparent, which articles have been selected for the report, which aren't selected and why not. … [I]t is accounted for in our reports." (C:2 20200212)

Although, the HTA-process starts with a question from clinical work the difference between the HTA-process and search instructions is the interaction between librarians and healthcare staff. The HTA-process is constructed in a systematic way where librarians start with broad overarching searches to find out different perspectives to grasp the question. The searches are then narrowed down when the HTA-team meet and discuss the questions (D:1 20210901, D:2 20210913, C:2 20200212):

> "A question is sent in, some from the library … [we] conduct what we call a preliminary search in the literature, maybe you can call it some kind of scoping search or something just to see what... if there is anything published at all, and if so what and is there enough literature to be able to produce an HTA-report from this question." (D:1 20210901)

After the start-up meeting the librarian begins the systematic searching in different databases depending on the topic (D:1 20210901) and sometimes the librarians also continue with the screening of abstracts before they hand over the search results to the rest of the HTA-team. Since the librarians do not have the specialized knowledge to evaluate the search results, the final decision on which articles to include is made by the healthcare professionals led by the HTA supervisor.

When the corona pandemic emerged there was limited knowledge about the virus, which caused challenges for healthcare professionals. The number of studies escalated quickly, and librarians compiled the studies even though they were not reviewed but made sure to explain the nature of the studies. To make continuous searching easier, the librarians put together a search string combining all the various concepts used for describing the virus in the beginning (C:4 20220321).

7   Discussion

The analysis shows how information literacy practices of hospital librarians are situated within a multi-polar discursive field and characterized by three main hospital library practices: clinical practices, information seeking practices, and an HTA-practice [cf. 26] where information literacy practices are constructed and performed in relation to issues defining the different practices. The construction of information literacy practices is closely connected to the positivistic nature of EBM and its prevailing norms and conceptions. In the following, we elaborate on the information literacy practices of hospital librarians connected to the research questions and structured by the identified main practices.

Connected to the second research question, the clinical practices interact with the information literacy practices of hospital librarians mainly in two different ways. The clinical practices are characterized by a holistic knowledge where nurses are caring for people, and a natural science perspective where doctors are deciding about the best treatments. In effect, there is a difference between the holistic and caring perspective on information literacy practices in contact with nurses, and the more specialized hard science view on information literacy when interacting with doctors. These conflicting points of view exemplify the tension between different epistemological perspectives [23], which connects to the third research question. This certainly has an impact on the information literacy practices of hospital librarians through clinical questions reaching librarians while they meet healthcare staff in different situations. In the relationship between nurses and information literacy practices of hospital librarians a holistic perspective meets an embedded and situated information literacy practice, performed together with clinicians. According to Wyer & Silvia [22] the practice of healthcare needs to be based also on other types of evidence than research based, for example storytelling about best practice. The narrative evidence is present especially in the clinical practices and is an important part of information literacy practices in the clinical practices.

What also characterizes the clinical practices is the challenges librarians face when trying to interact with healthcare staff, meeting a hierarchical healthcare organization where they also find difficulties reaching out with their competence and how they may support healthcare. The information literacy practices are then affected by the lack of interaction with healthcare staff, particularly doctors, who also represent an epistemology less compatible with non-positivist notions of information literacy.

Related to the first research question, within the information seeking practices the information literacy practices of hospital librarians are characterized by specialized knowledge of healthcare staff, utilized by hospital librarians through search assignments and search instructions. At the same time, the information seeking practices call for a more generic and streamlined view on information literacy. Connected to the second research question, included in both search assignments and search instructions are varying degrees of interaction between healthcare staff and librarians which connects a more positivistic perspective on knowledge with a generic view on information literacy practices, focused on searching for scientific evidence in research databases. In these practices librarians and clinicians do not interact as closely as in the clinical practices, which results in less understanding for the medical aspects of the search question. Therefore, more emphasis is placed on generic support connected to search instructions

and search assignments. The embedded information literacy practices are more evident in the clinical practices than in the information seeking practices where the interaction between healthcare staff and hospital librarians are less intensive.

To connect to the third research question, the HTA practice represents a strong and strict positivistic perspective on knowledge, in accordance with a natural science tradition. The HTA practice also illustrates a specific view on information literacy with a clear focus on scientific evidence. Hospital librarians can be viewed as facilitators of the evidence-based paradigm [19], but can librarians also provide a connection to a more holistic perspective on information literacy practices? The pedagogical and mediating role of the librarian is not as present here as in the information seeking practices. There is a generic way of working in the HTA practice since the actions by librarians are repeated for all search questions. The positivistic perspective collides with sociocultural perspectives on information literacy, otherwise often at least partly shaping librarians' information literacy practices. Perhaps most clearly, the evidence-based movement has influenced the information literacy practices of hospital librarians when they are engaged in the HTA-team.

It is evident that there is a movement towards more specialized knowledge and a positivistic epistemology through the clinical practices, the information seeking practices and the HTA practice. From the embedded and situated information literacy practices in the clinical practices to the more specialized knowledge and generic mediated information literacy in the information seeking practices to the most specialized knowledge and positivistic view on information literacy in the HTA practice. Given the actual context, librarians need to act and perform in different ways depending on the dominating epistemological view in each practice. This tension is discussed by Sundin, Limberg and Lundh [5], and this study makes it clear that different epistemological perspectives are present in different practices of hospital librarians which affects their professional practice.

According to the results, hospital librarians need to be more involved in the professional practices of healthcare staff to gain understanding of the practices and the epistemological perspectives in play. Kapitzke [7] points out the importance of the cultural context where information and knowledge exist, and to consider these aspects in information literacy practices. This would imply that hospital librarians should interact more closely with healthcare staff, in particular in the clinical practices and the information seeking practices to grasp the need for more specialized information literacy. In the clinical practices, information literacy is often performed as a situated practice emerging in interaction between hospital librarians and healthcare staff. Similarly, Kapitzke [7] argues for a more holistic understanding of information literacy, where contextual aspects are central.

The results show that healthcare privileges more specialized and positivistic views on information literacy, influencing hospital librarians' way of working. Since our results point at differences between information literacy in the evidence-based healthcare and the current Scandinavian LIS educational programs, this calls for awareness about the different perspectives on information literacy in existing practices connected to hospital librarians. Librarians in Scandinavia are often schooled into a socio-cultural perspective on information literacy, which rarely exists in evidence-based healthcare. This causes

tensions for hospital librarians who must adapt to a new way of mediating and communicating information literacy when interacting with healthcare staff. Since the evidence-based movement grows increasingly stronger in healthcare, hospital librarians need to relate their information literacy practices to a positivistic view on information literacy to be accepted as legitimate work partners in healthcare. This issue requires attention in LIS educational programs to increase the awareness of different perspectives on information literacy in different professional settings.

8   Conclusions

Answering the first research question, this study shows that the information literacy practices of hospital librarians are influenced by the over-arching epistemological perspective on knowledge in healthcare, the natural-science perspective. Three practices of hospital librarians identified in previous research [26] shape the information literacy practices: the clinical practices, the information seeking practices and an HTA-practice. Answering the second research question, information literacy practices connected to the clinical practices are found to be constructed in close interaction with healthcare staff with questions often arising from clinical work. This makes the information literacy practices focus on holistic knowledge, but also include a clearly specialized knowledge emerging from clinical issues. The information seeking practices influence information literacy practices through more specialized knowledge, reflected in search instructions and search assignments. The information literacy practices enacted by hospital librarians are constituted by generic instructions to healthcare staff, as the interaction decreases especially in connection to search assignments, compared to the clinical practices. The HTA-practice represents the most specific and specialized knowledge, and a positivistic view on information literacy according to strict guidelines. The evidence-based movement implies a rigorous framework for information seeking, influencing the information literacy practices of hospital librarians. The framework also entails that the interaction between librarians and healthcare staff decreases when the importance of the framework intensifies. The analysis shows an increasing complexity through the different practices where information literacy is performed by hospital librarians. The complexity is demonstrated by an expanding focus on specific knowledge and a positivistic epistemological perspective from the clinical practices, the information seeking practices, and to the HTA-practice.

The third research question focus on how information literacy practices of hospital librarians can be understood epistemologically. Information literacy practices of hospital librarians are influenced by the existing paradigm in the identified practices where information literacy practices are performed by hospital librarians. The overarching epistemological perspective in healthcare is a natural-science perspective where the information literacy practices are influenced by a positivistic paradigm. However, there is also, in particular in the clinical practices, an epistemological view focusing on holistic knowledge where other types of evidence such as narratives are crucial for the performing of information literacy practices. Therefore, the hospital librarians need to balance between different perspectives while interacting with healthcare staff in different practices. These findings suggest that LIS educational programs should promote an

increased awareness of different epistemological perspectives on information literacy practices in different professional settings.

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