Teachers in a Searchable World: Findings from an Introductory Survey

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Abstract. In this manuscript, we discuss the findings from an introductory survey conducted with more than 50 teachers in Italy. We inquired about teachers' opinions of educational technology used in the classroom, in particular search tools. Qualitative and quantitative data inferred from collected responses provide us with a multifaceted picture of the different roles teachers perform in the classroom when interacting with technology, their preferences, skills, perceptions of the needs for training, in addition to the principles and motivations that guide them. Findings emerging from this survey serve as a foundation for an international study that would allow us to better model teachers' needs and the barriers they face when using search tools in the classroom.

Keywords: Information retrieval · Search · Classroom · Teachers · Information access

1 Introduction

The digital era we live in has led to multiple academic and commercial efforts in the form of technology meant to support learning [4]. Among the many tools available, the most salient are search tools, from search engines like Google to educational environments like Wizenoze [27]. At their core, search tools serve as a starting point towards the democratization of information [17, 23]. These tools lower the barriers to access up-to-date resources—beyond textbooks—that can complement classroom instruction by helping students connect curriculum topics with real-life facts, in addition to enabling interactions with resources once unreachable or inaccessible [3]. Chronicles about search tools and their theoretical potential to ease and improve learning are common [1, 11]. Still, little effort goes into understanding teachers' preferences on these tools, their

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willingness to adopt them, how they use search tools to support learning[1], and teachers' efficacy to seamlessly integrate these tools to enhance learning [22].

To advance understanding of the practical implications and hurdles connected to educational technology usage, we devised a survey. We view this survey as a means to capture the behavior, preferences, modus operandi, and related concerns of a distinct user category: teachers. We ground our work on the assumption that for a productive integration of technologies at school teacher involvement is essential, as through them starts the transformation and evolution of teaching methodologies [6, 25]. Inspired by the layers of complexity defined by Murgia et al. [20], we turn to teachers of varied teaching experience and expertise on the use of technology. We do so to examine their predispositions to the use of educational technology in the classroom setting, as well as identify the traits that should guide design, evaluation, and adoption of search tools targeting children to complete tasks that are classroom-curriculum related.

Preliminary findings presented in this paper reveal insights about usual teachers' practices when adopting educational technology–particularly search tools–to complement classroom instruction. Findings also spotlight teachers' perception of students' views on search tools. Lessons learned will inform research related to the development of search tools and literacy instruction that reflect the real needs of the class. Moreover, outcomes from this work serve as a groundwork for an international, long-term study involving teachers from different countries that would help us best contextualize the needs, challenges, and expectations on technology that can support their teaching practices.

2 Data Collection

We designed a survey protocol[2] to elicit teachers' habits and perceptions on the use of educational technology in the classroom, particularly online search tools. The protocol is based on available literature and concentrates on five traits that contribute to the overall search experience for children in the classroom:

1. Different **roles** children play in the search process as discussed in [12]. The search roles introduced by Druin et al. [7] in their analysis of how children search for leisure at home were further investigated to account for the formal classroom context.
2. **Stakeholders**, beyond children, that influence adoption of search tools, as children are guided by adults both directly and by example in their choice of tools to use and strategies to adopt when searching [5, 9].
3. The concept of **relevance** when it comes to identifying resources that respond to information needs in a classroom context. Not much work exists on this topic, but it is of paramount importance to understand and describe how children measure the

[1] Here, we refer to both how teachers can turn to search tools to locate for information in preparation of classroom instruction [8], in addition to how they incorporate the use of search tools so that their students can complete inquiry assignments in the during class time or as a homework assignment [1], regardless of the teaching modality–in person or remote, as a consequence of the COVID-19 pandemic.

[2] For a copy of the survey questions, please reach out to the contact author.

performance of the search tools they are using according to their sense of relevance as discussed in [13].
4. The need for tools that foster interaction, engagement, and learning, since the level of **involvement** is essential for children to become proficient in searching for school-related topics [16].
5. The undesired and unpredictable behavior of **algorithms** that power search process, which posit ethical and social concerns as discussed in greater length in [14].

In essence, with the questions in this survey, we endeavor to capture teachers' experience with technology in general and with search tools, their attitude towards adoption, and their level of self-efficacy with such tools.

In this initial iteration of our work, we have administered this questionnaire (which was piloted beforehand) to a sample of teachers in Italy, all from a geographical region within the same educational system. We view this as a preliminary step towards a broader inquiry involving different countries around the world. It is important to note that due to the ongoing COVID-19 pandemic, the survey took place online. Moreover, teachers who completed this survey on a voluntary basis were recruited via Facebook and email. Following good practices and as instructed by the local ethics committee, we involved participants via personal contacts and asked them to reach out and invite other colleagues in education to take part in the study in a snowball approach. In the invitation letter, we informed them that data was collected for research purposes, kept anonymous and stored on a local protected server. Finally, we offered to keep participants informed on the progress of our research, and only for that purpose asked for their email contact.

From the 52 collected responses, the majority were primary school teachers (88.5%), the remaining were secondary school teachers. Teacher participants have a wide range of experience with teaching. The majority (54%) has been teaching for more than 20 years. Among the remaining teachers, approximately 17% have less than 5 years of experience, 10% between 5 and 10, and 19% between 10 and 20 years.

3 Results and Analysis

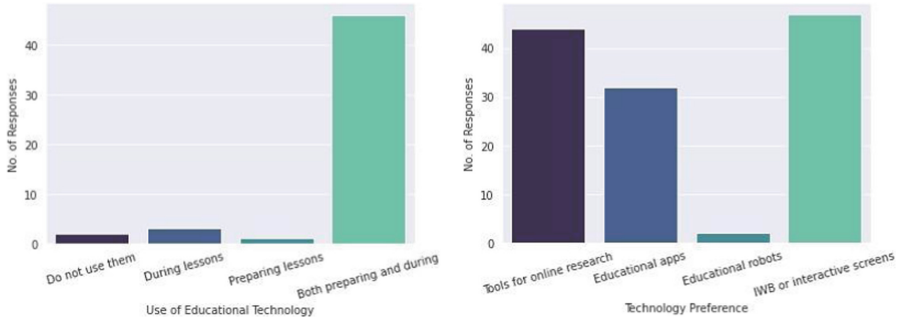
Here, we report on the findings from the responses provided by teachers; we also discuss observations and inferences emerging from collected survey data.

3.1 Teachers in a Searchable World

We live in a searchable world, one where information is a click away and every device comes with a dedicated search tool by default. To better understand teachers' view of this searchable world, we asked them to describe which tools they use when conducting online inquiries of a more personal nature, unlike tools preferred for classroom-related inquires. We also inquired about when and how they turn to these tools. Lastly, we encouraged teachers to describe their vision on the role technology can play in the classroom and include fears and concerns to be accounted for.

As illustrated in Fig. 1a, most teachers, regardless of their teaching experience, rely on educational technology both to support lesson preparation and aid classroom

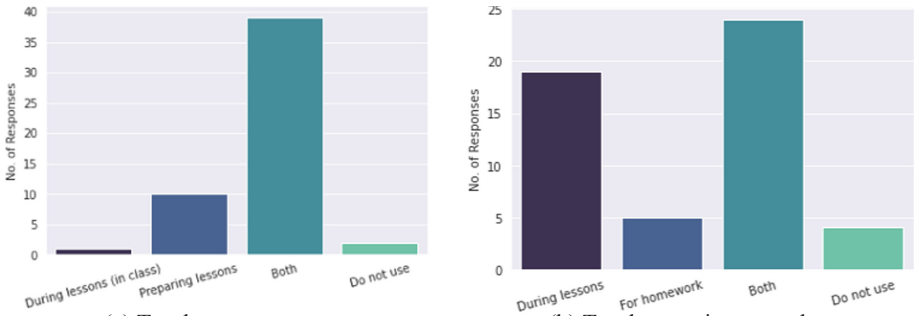
instruction. As for the types of tools used[3], it can be seen in Fig. 1b that teachers' choice is very broad–from interactive whiteboards (IWB) and search tools to robots. The latter, however, is not frequently adopted as an educational tool.



(a) When technology is used. (b) Which technology is used.

Fig. 1. Teachers' preferences on educational technology.

As previously stated, with the ubiquitous nature of search tools, we intended to understand the purpose driving teachers to these tools. From collected results, in their vast majority (75%) teachers take advantage of search tools both when preparing lessons and during their regular classroom instruction (Fig. 2a). Moreover, as showcased in Fig. 2b, close to 50% of the teachers ask their students to take advantage of search tools both during class as well as when completing homework assignments at home.



(a) Teachers usage. (b) Teachers assign to students.

Fig. 2. Teachers' reliance on search tools.

3.2 The Laundry Bucket: The Students' Side

Nowadays, students rarely organize digital resources as previous generations used to, adopting a nested hierarchy, i.e., directories, folders, and sub-folders. Instead, they are

[3] Note that as a response to this particular survey question, teachers could select more than one option or provide their own alternative.

known to create content not caring where it is stored and then pull what they need when they need it simply by searching. Students search an app or a resource in the same way: using the search tool provided on their device. This prompted us to query teachers on their preferred search tools and how they differ from those they reckon their students turn to.

From collected responses related to search tools teachers utilize, it emerges that in their vast majority, teachers use Google (90%), followed by Bing and DuckDuckGo. As for which search tool teachers believe to be regularly used by their students, Google again surfaces as the most prominent one (~94%); others mentioned include Qwant Junior, Qwant, and KidRex. In regards to the type of devices used to access search tools, very few teachers claim to not knowing or simply not using devices with their students. From those expressing their opinion on devise choice, it appears that approximately 50% of the students use Desktop computers, the rest a likely to use smartphones (~22%) and tablets (~16%).

Maintaining a focus on students, we asked teachers whether they in any way influence students' choice of tool. Collected responses from teachers who foster the use of search tools in the classroom and/or for completion of homework assignments reveal that close to 65% prefer explicitly indicating which search tool their students should use. Instead, the remaining teachers favor allowing students to turn to their chosen search tool for information discovery. Further, regardless of the search tool used, more than 93% of the surveyed teachers explicitly advise their students on how to use search tools.

3.3 Teachers' Beliefs the Use of Search Tools at School: Do We Need to Train the Trainers?

From the findings presented thus far, it is clear that search tools, among educational technology, are leaders in the classroom: these tools are more often than not, directly or indirectly embedded in the classroom setting. Emerging also from the responses is the fact that the daily use of search tools is not accompanied by an adequate knowledge and awareness on the tools themselves, both among teachers and students. This is why it is imperative to be cognizant of the level of expertise teachers' have on how to use search tools.

As captured in Fig. 3, it arises that teachers are seldom exposed to formal training on search tools. In fact, ~20% of surveyed teachers indicate receiving no training. Those seeking preparation on this area, mostly turn to colleagues and social networks for insights, with less than 30% enrolling in formal training courses. It is then unexpected that this pattern is also apparent when considering students' exposure to formal training on the use of search tools. From teachers' responses we surmise that at most, barely 30% of the students receive some sort of formal instruction on search tools, the rest depend on parents, sibling, or friends; with close to 10% receiving no tutelage at all.

To further understand teachers' perceptions on the impact search tools can have on learning, and therefore the need for more dedicated training in the future (for the teachers themselves and their students), we asked teachers three more questions. We summarize response distribution for these questions in Fig. 4. Overall, teachers agree on the fact that search tools can and do impact learning. More importantly, they strongly agree on

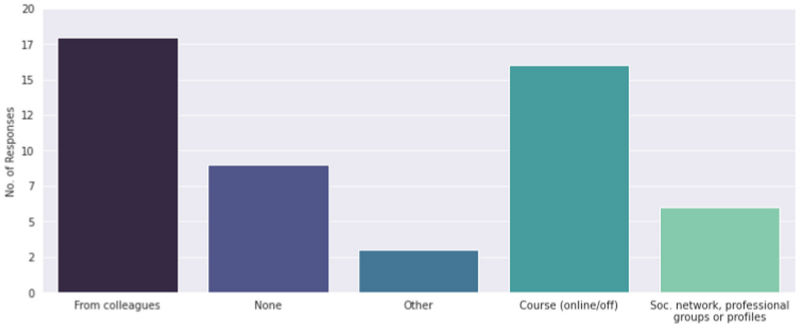


Fig. 3. Teachers' exposure to training on the use of search tools.

the need and importance of receiving training not only on the use of search tools but also on how to naturally integrate these tools to best support teaching and learning.

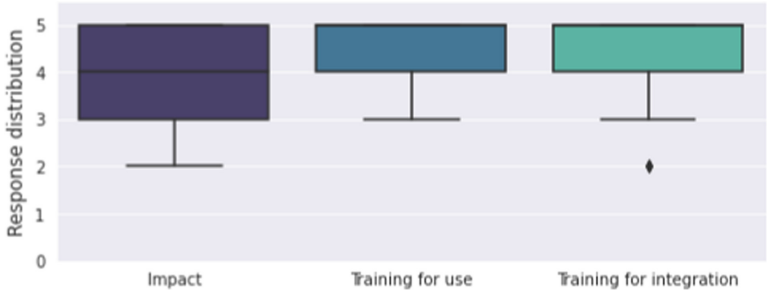


Fig. 4. Teachers' vision on the use of technology and the need for training–1 disagreement, 5 agreement.

3.4 Search Tools: Relevance, Interaction, Engagement, and Ethic Questions

We take a more in-depth look into expectations and requirements that teachers perceive as a must for search tools, if these tools are to be properly embedded to support teaching and learning.

We start by considering resources search tools retrieve and display in response to classroom-related inquiries. As captured in Fig. 5, when asked to select among a predefined set of characteristics, in their majority teachers expect resources to be reliable, closely followed by educational (80% and 69% of teachers selected these options, respectively). Other favored characteristics include engaging resources, written in a manner that students can read and comprehend, and that are up to date. It is noticeable that only ~20% selected "relevant" as a required characteristic in the search results.

We also inquired on primary expectations and concerns about search tools that can support learning. Teachers mention as their primary requirement the fact that in the use of search tools students have to be guided, followed by the need for them to be engaged

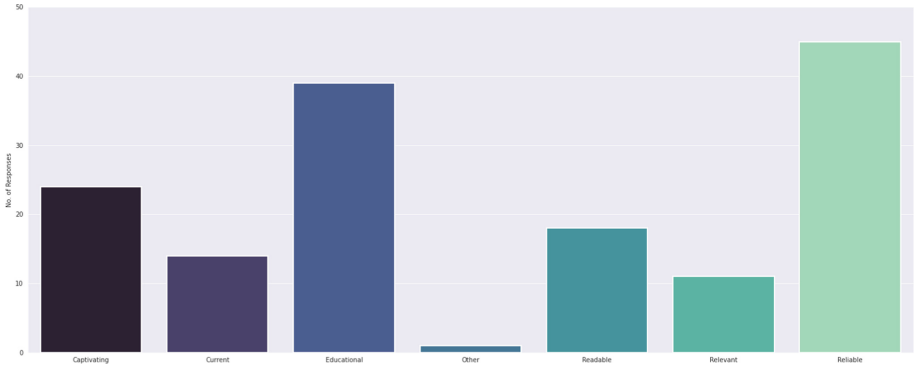
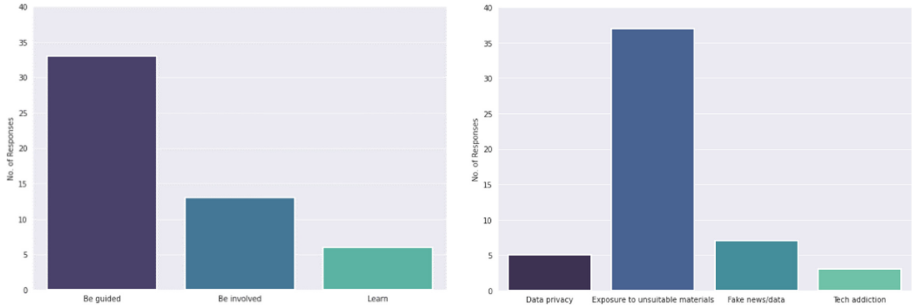


Fig. 5. Distributions of teachers' selected traits for resources retrieved and displayed by search tools for the classroom.

(see Fig. 6a). Only close to 16% indicate that students have to learn while using search tools. As for the major concerns associated with using search tools in a classroom setting, teachers indicate that exposure to unsuitable materials was without double a matter that could not be overlooked. Other emerging concerns included data privacy, interaction with fake news, and technology addiction (see Fig. 6b).



(a) Requirements. (b) Concerns.

Fig. 6. Teachers' views on search tools for the classroom.

3.5 Search Tools in a Changed World

As previously stated, data collection for this survey took place during the ongoing COVID-19 pandemic. With that in mind, we inquired on perceived changes, if any, teachers experience on their expectations and use of educational technology as a consequence of the pandemic. It was our intention to further contextualize emerging discoveries with the possible changes in common practices that could be directly impacted by the pandemic. In particular, we asked[4] teachers: Do the manner and the frequency

[4] Recall that this inquiry was presented to teachers as an open question.

in which you use technology in the classroom and/or your private life changed after the pandemic? If so, how?

We offer an overview of the collected responses to this question in the word cloud depicted in Fig. 7. Only a handful of the teachers (n = 6) mention that the COVID-19 pandemic has not affected their use of search tools in the classroom in any way. One elaborated on why that was the case by stating that this is because she does not believe "in the exclusive use of technology. The book and the teacher remain the main components of a valid learning path for pupils". Instead, in their vast majority, teachers disclose being more aware of search tools, developing better technology skills, being more reliant on search tools to locate materials for lesson preparation, and noticing an increase in the use of technology.

The general tone of the collected responses is positive, with teachers focusing on how, forced by the situation, they discovered how supportive technology could be of existing teaching practices. Teachers also appreciated that technology indeed facilitated content sharing among peers and with their students. Even so, teachers acknowledged the need for formal training–necessary to take full advantage of the potential technology demonstrated during this ongoing emergency period. Teachers also emphasized the need to revise the school curriculum to include elements for aiding the development of search skills in students. Among individual keywords in Fig. 7, DAD is quite salient. This term, an Italian acronym for distant teaching-education, often appears among teachers' comments as a flag of the effort teachers made and the opportunities they were given to keep school-related endeavors active even from remote, during the difficult lockdown period.

Fig. 7. Teachers' view on how their use of technology–particularly search tools– was affected by the COVID-19 pandemic.

4 Concluding Remarks, Limitations, and Future Work

Today's virtual world is largely a searchable one, facilitating access to a vast range of resources that are at our service using the magic wand of search tools. This remains true when considering education and specifically searching in the classroom. Integrating curriculum and technology requires "infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting" [10]. Thus, we expected the responses to the survey we designed to reveal favored tools and strategies that ease integration, in addition to gaps in technology and search literacy instruction.

Collected responses to our survey came from a sample of Italian teachers, most of them from a primary school where the research, exploration of new tools, and methodology are a constant in the history of the Italian primary school system, much more so than in the following school grades. Still, in Italy, there is no mandatory curriculum focused on media education in general, not in search literacy–the effective use of search tools to identify online resources satisfying users' information needs. Thus, we contemplated that the answers to the survey would significantly vary from school to school and even from teacher to teacher. It emerged from sample responses that teachers are aware of the importance of using online search tools in the classroom–as these account for the most used technology in preparing and administering their lessons. However, although search tools should (and often are) widely used in an educational context, it comes across that teachers feel that there is a lack of adequate tools that match the needs of students.

Another crucial issue emerging from collected responses points to the lack of specific training. This could aid teachers in taking advantage of search tools while avoiding potential risks often associated with these tools. Recall that the majority of the teachers declared they instruct students on which search tools to use and supervise how their students engage with search tools. That said, searching the Web is a scary experience for most of the interviewed teachers as they are warned more about the risks (e.g., unsuitable content and cyberbullying) than the opportunities. Even though existing works could ease this challenge by offering cues or automatically flagging possible unsuitable content [18, 24], it is still imperative to "train the trainer". In that way, teachers can become trustworthy guides for their students when they need to seek information online safely and effectively. Overall, conclusions reported in existing related literature [14, 15, 21, 22, 26], along with the results presented in this manuscript, confirm that teachers have a vital role in informing the design, development, and assessment of information retrieval tools for educational purposes. It is worth noting, however, that teachers' responses revealed that they believed that close to 30% of their students were supported at home by parents and siblings.

While out of scope, issues of inclusion and accessibility should also be probed in future versions of the proposed survey. This would enable understanding of teachers' perceptions on whether already-embedded device support (such as enlarging fonts or text-to-speech) is sufficient, or other aspects should be taken into consideration [2, 19]. Moreover, it will be of interest to the research community to deploy a similar survey among parents to also understand their views of search tools, as well as their expectations when these tools are used to support their children's learning process. Outcomes could have practical implications in designing, developing, assessing, and deploying search tools for the classroom context. The benefits of considering parents' perspectives have

already been reported by Fails et al. [9] as a result of discussions taking place during an interdisciplinary workshop on children and Information Retrieval systems (i.e., KidRec).

Insights and lessons learned from the analysis of collected survey responses can serve as guidance for educational researchers to further understand how to define the training and involvement of teachers to improve the integration and productivity of technologies at school. They also inform how tools can impact, in reality, not just in theory, classroom instruction and students' learning. In the future, we anticipate recruiting teacher participants across the full primary and secondary school grades. Doing so will allow us to discern challenges and preferences that might naturally emerge by the different manners in which teachers could take advantage of search tools in different grades. We also plan to extend the reach of this survey by administering it across different countries[5]. Doing so will allow us to connect with teachers worldwide to gather different perspectives on their perceptions and needs regarding search technology for the classroom. More importantly, deploying a survey such as the one we propose on an international scale would let us showcase whether and how countries' idiosyncrasies, teachers' experience, and search tool popularity correlate with adoption. We expect the curriculum and cultural traits of each country, directives, languages, and teaching practices will yield a broader range of opinions and emerging needs that researchers and practitioners should account for when designing and deploying search technology that can explicitly support teachers and students. At the same time, extending the reach of a survey like the one we discuss in this manuscript is not an easy feat. To connect with teachers worldwide, we intend to (i) participate in international conferences focused on education and attended by teachers, such as AERA[6] and ATEE[7], (ii) join workshops like KidRec[8] or IR4K[9] co-located with computer science conferences, during which we could form partnerships with other researchers and practitioners who can also reach teachers, and (iii) continue the snowball approach adopted in this current iteration of our work, but starting with international teaching associations, beyond Facebook or local contacts.

As mentioned in the literature [9], to be of use in a real-world setting, the design of tools that enable information access to children in an educational setting, such as search tools, should simultaneously account for multiple perspectives, e.g., teachers, parents, industry, and children, to name a few. Thus, it will be necessary to juxtapose outcomes emerging from surveys like the ones presented in this manuscript with those distilled from surveying, for example, children to identify dissenting voices. Vanderschantz and Hinze [26] already reported on how teachers' views and children's views differ when it comes to information seeking. Extending the ongoing work to include perceptions on search tools would advance understanding of current gaps researchers and practitioners should account for to best support the search in an educational setting.

[5] If you are interested in taking part of this worldwide survey, please email the authors for more details.

[6] https://www.aera.net/.

[7] https://atee.education/.

[8] https://kidrec.github.io/.

[9] http://www.fab4.science/IR4C/.

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