



Ethical implications for children's use of search tools in an educational setting

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ARTICLE INFO

Article history:

Received 15 January 2021

Received in revised form 19 July 2021

Accepted 10 August 2021

Available online 26 August 2021

Keywords:

Ethics

Search

Classroom

Teachers

Children

Guidelines

ABSTRACT

In the classroom, search tools enable students to access online resources. While these tools have many benefits in theory, in practice there are also ethical issues to consider. In this article, we discuss a number of ethics-related problems teachers are faced with and they need to find solutions for. Based on our own research experience developing and deploying information discovery tools for the classroom (both in a traditional classroom setting and on the Internet due to the ongoing outbreak of COVID-19), we share insights about ethics and the role of the expert-in-the-loop, teachers, both as co-design partners and liaisons between search tools and students. Furthermore, we introduce a set of guidelines, EMILIA, to assist teachers in recognizing and reflecting on ethical issues that arise from their use of search tools in the classroom.

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1. Introduction

Adoption of technology into the classroom in the 21st century has not been a smooth process. This is due to barriers including variable professional support and teachers' perception of technology, uneven technology access, and lack of shared vision on how technology can effectively support classroom curriculum instruction (Domingo & Garganté, 2016; Kearney, Schuck, Aubusson, & Burke, 2018; Muir-Herzig, 2004; Presby, 2017). Among the many tools aiding classroom instruction, we focus on those that support online inquiry tasks, i.e., completion of information discovery assignments (Chen, Meng, Zhu, & Fowler, 2000). Researchers and practitioners in academia and industry have studied for more than two decades how to design educational search tools explicitly tailored towards children (Anuyah, Milton, Green, & Pera, 2020; Azzopardi, Glassey, Lalmas, Polajnar, & Ruthven, 2009; Gossen, 2016; Gwizdka & Bilal, 2017; Landoni, Matteri, Murgia, Huibers, & Pera, 2019; Wizenoze: Delivering trusted digital content to learners, 2021). Nevertheless, two essential considerations still require attention:

1. The users (i.e., children in primary and secondary schools) and the designers emerge as the main stakeholders for technology design for the classroom; overlooking another

involved participant: the teacher who serves as the expert-in-the-loop (Murgia, Landoni, Pera, & Huibers, 2019).

2. Commercial search engines like Google, Baidu, or Bing are not ideal for classroom use, especially in early school grades. This is a consequence of users' privacy being at risk and content retrieved being at times indecent, unreadable, or simply not suitable for children, as it cannot always be filtered out (Anuyah et al., 2020; Esteve, 2017; Lupton & Williamson, 2017; Reyes et al., 2018; Smith & Shade, 2018; Vermeulen & Lievens, 2017).

These considerations spotlight the need for more advanced and dedicated search tools for the classroom to meet the needs and requirements of all stakeholders. Defining what makes such a tool *good*, however, becomes paramount, as with the introduction of search tools into the classroom context the 'source of all knowledge' is no longer the teacher but the Web – and not all Web resources are relevant and reliable (Vo & Lee, 2018). In 2019, researchers and industry practitioners met at the 3rd International and Interdisciplinary KidRec Workshop co-located with ACM IDC (Huibers et al., 2019) to craft four essential conditions for a *good information search tool for the classroom*: (1) It provides resources that are logically relevant, useful, and foster learning, (2) It is designed with a user-centered perspective while acknowledging that multiple stakeholder perspectives and needs exist, (3) Users are deeply engaged with the system, and (4) It is ethically sound and supports the rights of the child (Huibers et al., 2020). In the follow-up edition of the workshop (Landoni, Fails et al., 2020),

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attendees explicitly focused on *ethical* aspects associated with designing and deploying search tools for the classroom. Exchanges on what ethically sound means were preliminary and centered users' and designers' perspectives (Landoni, Pera et al., 2020). Informed by our prior research experiences (Landoni, Huibers, Murgia, & Pera, 2020; Murgia, Landoni, Pera et al., 2019), and inspired by outcomes from discussions during the latest edition of KidRec (Landoni, Pera et al., 2020), we posit that the teacher's perspective is at least as crucial as the user's and designer's.

In this article, we discuss the link between a good tool and the design process behind it, using pertinent *types of ethics* (Van Mechelen, Baykal, Dindler, Eriksson, & Iversen, 2020) as lenses for analysis. We keep the figure of the teacher as the beacon steering our analysis. We ground our exploration on research work we conducted over the past four years on information retrieval tools tailored to primary school classrooms – both traditional classrooms and online counterparts due to the ongoing COVID-19 pandemic – and anchored in education, human–computer interaction, and information retrieval disciplines (Aliannejadi, Landoni, Huibers, Murgia, & Pera, 2020, 2021; Landoni, Huibers, Murgia, Aliannejadi, & Pera, 2021; Landoni, Huibers et al., 2020; Landoni, Murgia, Huibers, & Pera, 2020). We present background information on ethics in the context of this work, i.e., the use of search tools in the classroom, in addition to the paradigm shift that occurs by embedding search tools into classroom instruction, showcasing, even more, the need for attention to ethical concerns (in Section 2). Besides offering our observations on the changing role of the teachers (Murgia, Landoni, Huibers, Fails, & Pera, 2019; Murgia, Landoni, Pera et al., 2019) and the dilemmas they are confronted with, we bring to light ethical issues associated with search tools (see Section 3). Lastly, we share a set of guidelines, which we denote EMILIA, that teachers can turn to as a way to get a sense of ethical considerations related to their choice of the search tool and its deployment in the classroom (see Section 4). Note that, while acknowledging their importance, we do not focus on user privacy and data protection, as these concepts have been widely explored in the literature (Dempsey, Sim, & Cassidy, 0000; Zhao et al., 2019). Instead, we elaborate on the specific ethical issues derived from using search tools to support classroom instruction and learning.

2. Connecting ethics, technology, & the classroom

The term **computer ethics**, first introduced by James H. Moor in 1985, is defined as the “analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology” (Moor, 1985). This definition emphasizes *individuals* interacting with technology, i.e., “human actions that are rooted in computer technology or influenced by computer technology” (Kizza et al., 2007). Almost 40 years later, we still face challenges that result from computer technology use (Kizza, 2013).

Given the focus of this article, we turn to the overview of 18 years of ethics in child–computer interaction research (Van Mechelen et al., 2020), which introduces eight different **types of ethics**. *Formal and informal procedural ethics* are concerned with the appropriate “procedures to protect participants from any harm”, whereas *situational ethics* deals with “unexpected events”, very common when working with children. *Participation ethics* is the type most closely related to our work, as it focuses on how researchers make sure children are actively taking part in a user study. It addresses the benefits children should get from taking part in research projects and the manner in which children's contribution should be recognized, accredited, and represented. *Design ethics* accounts for the detection and exposure of possible negative effects technology can have on the emotional and

social life of young users. Similarly, *everyday ethics* explores the dilemma and concerns generated by social interactions among the different actors in the context leaving technology aside. Finally, *teaching design ethics* and *teaching everyday ethics* deal with ways and means to get individuals, particularly children, to appreciate ethics as a means to unveil and reflect on the implications of choices made by designers and practitioners as well as in everyday life. While all types of ethics coexist in the classroom context, the EMILIA guidelines we propose here aim at raising awareness of teachers and support them as they deal with *situational* and *participation* ethics, as well as providing them with an understanding of the implications of *design ethics* on the introduction and use of search tools in the classroom.

Children of all ages regularly use search tools when completing their schoolwork, both in the classroom and at home (Chung & Neuman, 2007; Karatassis, 2017; Knight & Mercer, 2015). While **teachers** continue to play a central role in the children's learning process, they have inevitably out-sourced a part of their support for the learning process to search tools that are beyond their control. These tools increasingly rely on artificial intelligence (Chao, Chang, Wu, Lin, & Chen, 2016; Koch et al., 2020; Mitra & Srivastava, 2020; Villarronga, Kieseberg, Li, & forget, 2018), making them better suited to the task, but often at the cost of transparency in how they work. To understand the new and changing role of the teacher, it is imperative to acknowledge the **paradigm shift** imposed by the use of search tools in the classroom (Murgia, Landoni, Huibers et al., 2019), even more so when the teaching takes place at distance. We start with the *traditional paradigm* without the use of search tools. A teacher gives individual or groups of students an information discovery task, for instance, “what is a tornado?” The students then turn to library resources or document sets selected by the teacher such that while reading and browsing, they find the answers they seek. In the *new paradigm*, which takes advantage of search tools, students neither depend on teachers' document sets nor do they go to the library. Instead, they turn to the Web and use popular search engines (e.g., Google) or other educational search tools as a starting point in their quest for information. Based on the list of results shown, students click on links, and while reading and browsing, they can find their answers. While alike, these paradigms pose different demands on the students and their teachers, as information seeking no longer takes place in a controlled environment, which results in unpredicted dilemmas and ethical concerns. We summarize the main differences across paradigms in Table 1.

Traditionally, teachers could rely on curated textbooks and their logical structure to direct student learning (e.g., “read in chapter X, from page Y to Z”). Pointing students to the right information source is not an action that can be directly mimicked if search tools are the portal to the sources containing such information – partly due to teachers' lack of familiarity with search tools, both in terms of algorithms and the content they can provide (Ekstrand, Wright, & Pera, 0000). Moreover, the Web is dynamic, i.e., new resources become constantly available, making it impossible for teachers to keep up with new options they could point their students towards (Murgia, Landoni, Pera et al., 2019). The area of influence of search tools is not limited to traditional classrooms as search tools also support online education, a mainstream mode of instruction nowadays (Ortagus, 2017), particularly given the current COVID-19 pandemic (Aliyyah et al., 2020). Unfortunately, the distance between the teacher and the student during the search process has become greater with remote instruction. Recent reports state that “more than one in three teachers lack fundamental technical and pedagogical skills, so providing teachers with the necessary training would certainly improve online teaching” (OECD, 2020). Further, conclusions resulting from examining teaching practices during COVID time

Table 1
Comparing old and new paradigms of information-finding for the classroom.

Focus	Old Paradigm	New Paradigm (Incorporating search tools)
Approach	User-centered (Teacher)	System-centered (Search Tool)
Traceable	Turning pages in a book	Browsing through websites, sometimes lost in hyperspace
Education	Books are pedagogically organized often structured and written to be used in the classroom	The Web is a chaotic and heterogeneous content collection
Familiarity	Teachers are often well-versed on the content	Teachers are not always familiar with the content retrieved or, even more so, with the search tools themselves
Teaching perspective	Every child has his/her own educational approach	Every child is for the system 'a user' no matter her/his background or study level
Content perspective	Each book is the same for each child	Every presented document is the result of earlier search actions with the browser

shine a light on the fact that teachers are experts in their disciplines, but “how instructors develop skills in online teaching is neither systematic nor codified in higher education” (McGee, Windes, & Torres, 2017). Thus, not all teachers are prepared to teach students equitably and with inclusivity (Quezada, Talbot, & Quezada-Parker, 2020). The choice of the search tool to support classroom-related activities and awareness of the consequences of using such a tool becomes that much more important for teachers, parents, and students alike.

The lack of transparency of algorithms, the breadth of online resources available (that, unlike textbooks, are curated), and varying levels of digital know-how induce issues for teachers to confront. Informed by existing literature and our experience designing search tools for primary school classrooms, we discuss in Section 3 why we attribute most of these issues to ethical dilemmas teachers encounter as a result of introducing search tools into the classroom setting.

3. What we learned: Teachers, search tools & ethics

Over the last four years, we have examined several aspects of search tools in an educational setting (Aliannejadi et al., 2020, 2021; Landoni, Fails et al., 2020; Landoni, Huibers et al., 2021, 2020; Landoni et al., 2019; Landoni, Pera, Murgia, & Huibers, 2020; Milton, Murgia, Landoni, Huibers, & Pera, 2019; Murgia, Landoni, Huibers et al., 2019; Murgia, Landoni, Pera et al., 2019; Pera, Murgia, Landoni, & Huibers, 2019). At the core of our research are the educational needs of our participants as assessed by educators and teachers, and children's rights as recognized by UNICEF (Assembly, 0000) and D4CR Association (D4CR Association, 2019). Leveraging (i) insights and findings resulting from our aforementioned research projects, (ii) comments made by teachers as they proctored user studies in their classrooms, and (iii) observations by an expert educator, who is part of our research team, we discuss emerging ethical considerations associated with the design and later use of search tools in the classroom. In particular, from our prior work, we collected search logs, students' pre-task and post-task surveys, and teachers' notes during and after proctoring studies in their classroom. Quantitative examination of collected data is reported on Aliannejadi et al. (2020, 2021), Landoni, Fails et al. (2020), Landoni, Huibers et al. (2021, 2020), Landoni et al. (2019), Landoni, Pera, Murgia et al. (2020), Milton et al. (2019), Murgia, Landoni, Huibers et al. (2019), Murgia, Landoni, Pera et al. (2019), Pera et al. (2019). Along the way, we noticed findings of a more qualitative nature starting to emerge from empirical results and associated teacher feedback.

Under the guidance of the expert educator in our research team, we engaged in a “participatory affinity identification” process as described by Martin, Hanington, and Hanington (2012)

and distilled comments and findings into printed cards. We organically let main groupings emerge as categories. Together, we assigned each category a descriptive label, resulting into the seven we used in the manuscript to describe what we learned and related ethical considerations. Even though the seven categories we consider apply to the school context, they could be generalized to any other learning context, formal and non-formal.

We begin by addressing participation ethics and highlighting how we as researchers have always been interested in designing tools that benefit children and other stakeholders, mainly teachers, taking part in our studies. More importantly, informed by the types of ethics we introduced in Section 2 and following the same terminology, we provide insights into ethical dilemmas we encountered, along with how they influenced our research path and the role teachers play in making ethical decisions to ensure children have a *good* tool to use. We do not concentrate on the formal and informal procedural research ethics, as these are linked to the specific context of user studies and we assume that educational institutions where these studies take place have at their core the mission to protect children from any harm, thus performing the role of ethics authority. Instead, we discuss how to deal with *situational* and *participation* ethics. We also consider *design* ethics, and so we assign teachers, given their expertise, a crucial role in managing unexpected events and making sure all children are given an active role in the design process, their contribution is properly recognized and there are no negative effects caused by the technology on offer.

3.1. Inclusion and diversity

We consider participation ethics across user studies informing our research, in terms of accounting for inclusion and diversity. By working with teachers and children at school we aim to (i) increase inclusion beyond the usual circle determined by parents' connections and effort to find and register their children in educational activities they consider beneficial and (ii) avoid bias that may occur from participants coming from households that would likely be more enthusiastic about proposed new technology and related activities, given their technological background. Moreover, running studies in a classroom setting somehow mitigates the digital divide. This allows us to assume a more uniform level of support, skills, and technological means for all study participants. In fact, teachers aware of the different levels of competence for each child in the classroom could smooth barriers by ensuring that each child is comfortable and able to take part in our studies. Lastly, having a teacher run studies helps with motivation and support by providing clear instructions delivered in a form already familiar to children.

3.2. Active role

Looking further into participation ethics, the importance of having children play an active role in the design of new tools is discussed in [Aliannejadi et al. \(2020\)](#), [Landoni, Huibers et al. \(2021\)](#), [Landoni, Murgia et al. \(2020\)](#). In these user studies, children took the role of co-designers and engaged with ideation activities. They were asked to interact and critically judge a set of emojis used to enhance Search Engine Result Pages (SERP). After expressing their opinion on the proposed pairs of emojis identifying relevant and non-relevant results (as per expert judgment), children were asked to design and draw new pairs that they would use for future searches in the classroom. Based on these drawings, we built an enhanced SERP to scaffold primary school children in their school searches. Teachers acted as facilitators and co-designers during an initial critiquing phase – helping children organize their contribution to the discussion – and later on when helping children reflect on the meaning of relevance and how new emojis could support other children performing school-related searches.

3.3. Recovering from errors

As we discussed in [Aliannejadi et al. \(2021\)](#), when asked to use search tools to locate information to answer 12 questions related to a common primary school subject, only 31 of the originally-recruited 100 participants completed the task. An in-depth analysis of our data revealed that most of the students who did complete the task belonged to the same classroom. In this case, the teacher had previously established a mentor and monitor system to support children and help them transition to remote instruction. This mechanism dealt naturally with situational ethics issues as it made children feel comfortable and free to safely make mistakes. Unfortunately, study participants from other classrooms lacked this extra support and had to deal with the extra cognitive overload of participating in the study online. We believe that this led them to give up easily and not complete the required task even if all other conditions were the same. Hence, teachers' ability to mentor and monitor children interacting with technology seemed to make the difference.

3.4. Benefits and motivations

In the study presented in [Landoni et al. \(2019\)](#), we explored whether a Vocal Assistant (VA) could serve as an intermediary between a child and a search engine to ease query formulation and foster completion of successful searches. We also examined the potential influence a VA has on the search process when compared to a traditional text-driven approach. Children were asked to complete (after school) a set of inquiry tasks set up by researchers in line with their interests and abilities. There are two main ethical issues to consider related to situational ethics: what are the benefits for children in taking part in our study instead of spending their time studying or playing? and how do we ensure that proposed search prompts are of interest and at the right level of complexity to engage children with different abilities? In our case, study participation was on a voluntary basis and primary school teachers, familiar with the curriculum and interests of the target audience, helped us find the right prompts. Along with the teachers themselves, we saw the value in proposing suitable search prompts to engage and motivate children, a task for skilled teachers and experts in education.

Still, these two issues sparked a series of consequential questions: where is the child's motivation coming from? who decides when the search is complete? who decides if the search has been successful? Perhaps researchers comparing results with ground

truth or maybe the children themselves based on how much they enjoyed the search experience, how much they learn from it, or how much fun it was to practice reading and writing while searching? What about the pleasure of discovering unexpected new content and overall serendipity? These open questions triggered our quest into better understanding children's search behavior and in particular what defines a good search experience for children in the classroom. At the same time, it surfaced that teachers played a crucial role in the definition of our research space as they not only acted as facilitators during our studies but also as experts in its design and, more importantly, as part of a dyad together with the children as users and assessors of the tool and its performance. Teachers liaising with children in the classroom and when teaching online, with their families as well proved an asset.

3.5. Emotions

Inspired by a recent study based on adult users on the role emotions play in web search ([Kazai, Thomas, & Craswell, 2019](#)), and focusing on what motivates children in their search experience, we explored whether and how children searching in a school context react to the emotional content often part of SERP ([Landoni, Pera, Murgia et al., 2020](#)). We did so by examining emotions inferred from queries and corresponding retrieved results in query logs produced by children ages 9 to 11 in a classroom setting in 3 different countries.

From the design ethics point of view, we question on the one hand if it is right to expose children to content charged with negative emotions. On the other hand, we also consider the value of depriving them of the opportunity to encounter material that may get them excited and inspired to learn by searching. This dichotomy led us to reflect on who decides what is right and what is wrong when children search, in terms of helping them locate what they are looking for or triggering their curiosity and their ability to search for learning? Is this up to the person setting up the search task (teacher), or the person running it (child)? How much support, explanation, feedback, training do children need to be able to independently engage in a rewarding search experience? Besides, if we agree that a healthy diet of mixed emotions is important for children development, then how do we ensure they are not exposed to content that could affect negatively their growth? What is the right level of adult support and how can technology aid the adults providing it? In our case, we had teachers acting as mentors and facilitating children's interactions with emotional content.

3.6. Influence

Framed on design ethics, we looked for answers to the right level of support and how technology can provide it ([Milton et al., 2019](#); [Pera et al., 2019](#)). We studied the use of recommendations by and for children (ages 9 to 11) in an educational setting and explored whether children could be convinced to put the trust they naturally have in their teachers onto search tools. From our preliminary analysis, it becomes apparent that recommenders could provide extra support to and help children complete inquiry tasks. Nonetheless, children have difficulty in recognizing the role of the recommender regarding aiding information discovery for classroom assignments. The ethical questions that arise are: is it correct to influence children by providing them recommendations instead of setting them free to define and apply their own search strategies? and should we make it transparent where the recommendation come from – are they truly coming from peers (i.e., children) or filtered based on teachers' judgment? If so, should search tools support requirements set up by teachers or

by children? And what about parents' beliefs and requirements? It is not necessarily up to us, researchers, to make this decision, but should we at least make visible the requirements directing the design of our search tools? Furthermore, do recommendations provide long-term help towards learning how to search, or are they just a shortcut to get answers to a school assignment without really learning about it? In our case, to address some of these ethical dilemmas, teachers provided clear instructions about what they expected children to achieve and helped those in need of extra guidance while letting others explore independently.

3.7. Scaffolding

We aim to design tools that provide the right level of support, i.e., help children make their own choices without acting as influencers (Aliannejadi et al., 2021; Landoni, Huibers et al., 2021; Landoni, Murgia et al., 2020; Milton et al., 2019). We questioned if it is right to present children with ad-hoc interfaces to support their search activity in the classroom, and what are the benefits of using these ad-hoc interfaces in regards to support and scaffolding during relevance assessment as opposed to fostering learning directly to cope with a tool children will use as adults. Are we spoon-feeding children and stopping them from developing literacy skills? Or, as we advocate, is this quite the opposite? We feel it is up to the experts in education and teachers to decide when and how to use tools to scaffold children's learning. For this to happen, experts need to first experience these tools and fully appreciate the way they work.

4. What we propose: EMILIA guidelines for adoption of search tools in the classroom

We have distilled a set of guidelines for teachers to consider when using search tools as part of their regular classroom instruction – in person or a remote setting. With the EMILIA guidelines, we emphasize our belief that a deep understanding of the implications of design and everyday ethics (defined in Section 2) is essential for teachers; so is the need for teachers to have a clear appreciation of the tools they expose children to in the classroom. Note that the EMILIA guidelines are the result of our own past research experience (summarized in Section 3). More importantly, interactions with teachers during the process of designing, assessing, and deploying search tools for the classroom informed and helped identify the initial set of guidelines presented below.

E Experience it first. A teacher has to experience directly and verify ahead every search prompt to be cognizant of results the search tool can deliver, i.e., are retrieved resources readable, reliable, and relevant given the education purpose? We first saw the need for this in the studies we discussed in Landoni et al. (2019) and Aliannejadi et al. (2021). In both cases, a teacher, who is an expert in education and a member of our research team, guided the study preparation and verified search prompts. We also made sure to keep the same conditions as to be found on the devices used in the classroom (e.g. presence of cookies and search history) and this allowed us to identify relevant material for each of the proposed search tasks and pass these to the other teachers running the study so that they could trust it to be an educational activity. In the study reported in Aliannejadi et al. (2021), we learned it was important for us to invite teachers to explicitly experience the study first to be ready to deal with children's questions and requests for clarifications, the unexpected side of the study accounted for by situational ethics, as the majority of the teachers, given how busy they were with online teaching, failed to do so spontaneously and found it hard to cope with children's requests.

M Mentor and monitor. A teacher has to mentor and actively monitor the search process from beginning to end. This can be done by starting to work on one representative search task together with the children and showing what happens step by step. In this way, This way everybody understands the steps to take and there is no peer pressure due to (perceived) different search experience. For the study reported in Aliannejadi et al. (2021), we invited teachers to find ways to help children in the classroom get familiar with the search tasks and running the exercise online. One of them made herself available to answer questions related to running experiments online and any specific doubt on the assigned exercise. This extensive trouble-shooting support proved the most effective way to get children to complete the search assignment while addressing participation ethics.

I Identify. Teachers must identify simple and safe information-seeking tasks that fit with the school curriculum. For instance, in Landoni, Pera, Murgia et al. (2020) teachers prepared a presentation about how pyramids were built in ancient Egypt giving enough information for children to understand what to look for and deliver. Instead, prompting children to complete a 'random' information task about ancient Egypt would not work due to the lack of details concerning the search context. This guideline ensures children's active participation in the study by deeply engaging them in the proposed activities.

L Liaise. Teachers should liaise with the family and involve them when and if possible in what children do at school, and in what context. This becomes an even more pressing issue when teaching takes place remotely. Using the computer at home for searching is different than doing so in the classroom, due to technical (e.g. presence of cookies on a shared device), emotional (feeling lost and/or lonely) and cognitive (lack of help and support from teacher and peers) reasons. All issues to be considered under design ethics. Search tools based on artificial intelligence leverage users' search history, location, and time of a search for result retrieval and ranking, thus results could differ in the classroom vs. at home. The question arises if this helps or just confuses the children doing their homework at home.

I Instruct. In preparation for a study, as part of design ethics, a teacher has to define strict instructions and directions to describe what to do step by step, and specifically provide recovery instructions detailing what to do when a child gets lost. This is particularly crucial when classroom instruction takes place remotely and children miss the direct support of teachers and peers. In one of our studies (Aliannejadi et al., 2021), the children who were given precise instructions submitted the complete search assignment; others left the study because of the lack of support, with clearly impacts participation.

A Appreciate. A teacher should have a deep appreciation of how indexing and retrieval algorithms work, the collections that search tools index and retrieve results from (e.g., are they open or closed domain, dynamic or static, manually curated, and if so by whom), whether privacy is protected, and what are the risks of adopting a particular search tool, all issues covered by design ethics. It is only then that teachers can guide children using search tools. Teachers are encouraged to also explain that to children's immediate families so that there is still a safe search experience at home. For example, for the study discussed in Landoni,

Pera, Murgia et al. (2020) it was critical for teachers to experience and appreciate beforehand how a search tool would react to emotionally-charged queries to be ready to discuss with the classroom the retrieved results and the emotions these could evoke.

5. Concluding remarks and next steps

Grounded on different types of ethics (Van Mechelen et al., 2020), we chronicled lessons learned informed by our research experience, highlighted the importance of the role teachers play as experienced mediators in the search process proposed in a classroom setting, and offered a set of guidelines (denoted EMILIA) that teachers can consider – from an ethical standpoint – when selecting, engaging, and incorporating search tools to support classroom instruction. Via the chronicle of our research work, we aim to bring awareness on pitfalls, challenges, and opportunities that *researchers* could consider – from an ethics perspective – when designing, assessing, and deploying technology to support children in the classroom context. With the EMILIA guidelines, we aim to steer *teachers* to focus on the implications of design, situational and participation ethics and understand the intricacies and ethical considerations of bringing search tools into the classroom (in its traditional or online form).

While this area requires more discussion, we hope our contribution can be the starting point for others to take this matter further. It is worth emphasizing that we produced the EMILIA guidelines as a catalyst for teachers to reflect on ethical implications associated with using search tools to support classroom instruction that either implicitly or explicitly affect the overall classroom environment. The EMILIA guidelines have to be put in practice and assessed with teachers from different educational systems and countries. Further, their impact on the different types of ethics can only be verified/confirmed once adopted by peer researchers. The dyad made of classroom and teacher needs to be studied in different philosophical belief systems, for instance, to better understand the effect of an idealist versus an existentialist approach have on the design of new tools for children to use in the classroom. After all, ethics belong to philosophy, not science, and should be treated accordingly. Ethics should drive reflection and assign a purpose to research while not being subjected to similar expectations in terms of performance. More so when looking for answers, ethics can only provide a frame, not a binary result.

6. Selection and participation

Discussions presented in this manuscript are the result of post analysis of existing studies (Aliannejadi et al., 2020, 2021; Landoni, Huibers et al., 2021; Landoni et al., 2019; Landoni, Murgia et al., 2020; Landoni, Pera, Murgia et al., 2020; Pera et al., 2019) and therefore no participants were recruited for this particular work. It is important to note, however, that data and observations that we gathered as a result of our prior studies involved teachers and students who participated on a volunteer basis. Moreover, permissions from parents as well as respective school directors were secured before any study took place. Lastly, the corresponding Ethics Committees approved each of them.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr Elisa Rubegni, Assistant Professor, School of Computing & Communications, Lancaster University, UK.

Acknowledgments

The authors would like to thank the students and teachers who participated on our studies both in Italy and Switzerland. Their willingness to collaborate with us, even during the COVID-19 pandemic, is deeply appreciated.

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