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The future scribe: Learning to write the world

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This study takes its point of departure in academic scholarship that points to how programming – reading and writing code – is the literacy of the future, in other words, non-specialized competence that should be acquired in education in parity with traditional reading and writing skills. The goal is to shed light on how programming can be orchestrated in education to break with the outworn dichotomy between the 'two cultures' that C. P. Snow formulated as a gap between, on the one hand, natural sciences, mathematics, and technology, and, on the other hand, the humanities, and social sciences. A discursive analysis of Swedish policy documents and curricula forms the empirical ground for discussing how reading and writing code are introduced, taught, and learnt within Swedish compulsory school. The results show that Swedish curricula are framing programming as specialized knowledge within technology and mathematics, rather than allowing it to be a dimension of several subjects, such as the humanities and social sciences. These findings are discussed in the light of recent studies in education that have explored interrelations between coding and reading and writing texts. The discussion leads up to suggestions for implementing reading and writing code as digital literacy in education.

KEYWORDS

digitalization, education, Sweden, literacy, coding, programming, reading, writing

Introduction: The imaginary of the future scribe

In a study dating back to 2008, carried out in the virtual world of Second Life (Lindberg, 2013), the investigation of social learning between avatars and virtual things led to an uncanny encounter with an avatar named "Future Scribe." The character appeared in the form of a "black box," and a click on its profile revealed that this peculiar in-world resident made their programming skills in different languages available to other inhabitants against payment.

Considering developments with regards to education, computational thinking, and programming during the last decade, this lived and invented "story-event" (Lindberg, 2019) from Philip Rosedale's virtual world, infused with the vision of "digitiz[ing] everything" (Rosedale, 2007), is informative in several respects. For instance, it activates links between the past, the present, and the future with regards to historical awareness of literacy development. The scribe can be traced back to the second millennium B. C. E., and to a long era of expert writing, vis-à-vis 'folk' writing, during which professional scribes were engaged for reading and writing agreements, keeping administrative records, and transferring messages between people (Avrin, 2010). Scribes were employed to handle different languages and linguistic registers, and lay people had to trust in their mediating competences to uphold communication between individuals and organisations across time and space.

In our era, these writing professionals are still present. A persistent view of modern civilisation as literate is relative (Graff, 2022) and cannot circumvent the fact that in changing

landscapes of continuous and diversified text fabrication, the scribe is transformed into categories, such as, 'editors', 'communicators', 'translators', 'linguists', and 'proofreaders'. Moreover, scribing specializations seem to be broadening with the arrival of scripting and coding on the reading and writing arena. This is highlighted in the Second Life anecdote by the word-combination "Future Scribe," signalising coming days (that are already here) where computer language skills are unattainable for most of the population but needed in every-day life. The Future Scribe thus addresses a forceful sociotechnical imaginary (see Jasanoff and Kim, 2015; Cerratto Pargman et al., 2023; Ross, 2023), wherein is expressed the transition from a printed knowledge society towards a (post)digital context (Arndt et al., 2019). The main message of this image is that skills with words not necessarily offer the power to shape the world, since the environment increasingly is dictated by codes (Vee, 2017), which is particularly true in virtual worlds (Lindberg, 2013, 2019).

Moreover, the scripting languages managed by the avatar are encapsulated in the form of an inaccessible "black box" that has become a widespread image to illustrate how software is "expected to produce a certain output given a certain input" (Van Zundert et al., 2020, p. 124) and how "code is a more or less a withdrawn or even covert, but nonneutral, technology" (Van Zundert et al., 2020, p. 124). As Van Zundert et al. (2020) argue, despite the acquired science and trustworthy technology that "black boxes" represent, social sciences and the humanities tend to distrust the very phenomenon of "black boxes" – because they are not readable. Thereby the scribes that have fabricated them are discredited by representatives of disciplines that historically had the power over scripting abilities:

> Thus the labelling of a particular software technology as a 'black box' has come to mean, in some parts of the humanities, precisely the opposite of what was intended: rather than signalling that 'this is a trusted instrument', it signals 'this is an instrument which is suspect, and deserving of critical attention.' (Van Zundert et al., 2020, p. 127).

In this way, the reported "story-event" in Second Life reveals collectively held visions of what reading and writing is and could be, hiding the question of what literacy, i.e., reading and writing skills, will be of tomorrow.

Since the concepts of reading and writing are undergoing transformations, this article's aim is to initiate a discussion on the conditions for approaching reading and writing texts to reading and writing code in education. This first stage implies a discursive analysis of recent Swedish curricula for compulsory school and the national digital policy for schools. The overall goal of the investigation is to shed light on how programming and coding can be orchestrated in education to break with the outworn dichotomy between *The Two Cultures* (Snow, 2012). Since C. P. Snow's lecture in 1959 on the separation between the humanities and the engineering sciences, education is haunted by a divide that prevents conversations across disciplines on current technological development. This awareness of a tension between academic cultures has encouraged interdisciplinary initiatives, such as, the Wallenberg AI, Autonomous Systems and Software Program – Humanities and Society (WASP-HS) in Sweden (see web site: wasp-hs.org). The study is situated in Sweden, which is the context the authors are familiar with, including perspectives from the Nordics and beyond. It could also be argued that the concurrence of categories of reading and writing in computer science and the humanities is particularly favourable to observe in these digitally advanced cultural and educational spaces (Ainley, 2018). The structure of the article is divided in four sections. The first section deals with how the intersection between reading and writing code vis-à-vis reading and writing text has been articulated in research. The second section addresses programming in the Swedish school system and describes the method used in the analysis of policy and steering documents published by the Swedish School Agency. The third section reports on the analysis and findings, followed by a fourth part that discusses the results and points to alternative pathways for implementing programming in Swedish compulsory school.

Situating reading and writing across the humanities and technology

The tendency in current imaginaries of reading and writing of tomorrow is to address computational thinking skills as the predominant critical thinking, in a world where communication is bound up with technology (Fang et al., 2022). Changing views of communication transforms the status – role and function – of spoken and written words which increasingly become dependent on digital solutions, to be shared among people. These transformations are reflected in discourses on reading and writing of a postdigital era (Jandrić et al., 2018), wherein two different strands are identifiable. They address interdependent functions of reading and writing, that sometimes are presented as competing aspects.

One strand underscores the production and uses of texts that mimic human communication. However, what we mean by reading and writing in different contexts, situations and with regards to specific purposes has been a subject for research and transformation since the 1960s, if we are to subscribe to Graff's (2022) historical overview of new literacy development. This is not least tangible in language and literature education, where multiple languages, Computer Mediated Communication (CMC) (see, for example, Korvesi and Michel, 2022), multimodal texts and changing 'bookishness' (Pressman, 2020) throng in the same classroom (Bagga-Gupta et al., 2019). The diversification of reading and writing practices is obviously fuelled by digital technology development. As Haas (1996) argued in her studies on writing with digital tools, technology underscores the materiality of human communication (see also Hayles, 1999, 2002), while warning for that issues of literacy in a media dense world "is being debated by a narrowing subset of the profession" (Haas 1996, p. 169), and that the "Technology Question is being taken care of by somebody else, or that it, in fact, has already been solved" (Haas 1996, p. 169).

The other strand underscores that scholars in technology studies are taking over discourses of literacy of tomorrow and advocates a computational perspective on reading and writing. Vee (2019, p. 3) argues that "educators and programming professionals have made the connection between writing and programming since at least 1961 – almost as soon as computers became commercially and educationally viable." In scholarly discussions this type of discursive relations and comparisons is present, for example, in Bruno Latour's (2008) analogy between linguistic features of storytelling and technological inventions, and in Hayles' (2005) *My Mother was a Computer*, where she states that "language alone is no longer the distinctive characteristic of technologically developed societies; rather, it is language plus code"

(16). Even though current scholarly discourses "draw parallels that associate reading and writing code with reading and writing text" (Vee, 2017, p. 1), there are obvious divides between these designated activities. Hayles (2005) observes this opposition as being between the figurative aspect of language and the focus on action in coding.

Whether the point of departure is figurative language or codes of action, scholarly discourses tend to draw a fine line in the sand between the two. The "Regime of Computation" (Hayles, 2005) thereby contributes to define literacy, and computation steps into reading and writing endeavours, acquiring a function that contributes to shaping text production and the world (Hayles, 2005).

Analogies and interdependencies between reading and writing text and code are further echoing in two recent books on the topic, one from the field of digital humanities, and one from the field of computer science (Vee, 2017; Edmond, 2020). Vee (2017) uses reading and writing to promote a democratization of coding, with the aim to make scripting a basic literacy skill for all. Edmond (2020) aim is to overcome "the critical traditions and strong commitment to qualitative approaches inherent in the humanities [that] leave the digital humanities at risk of being caught between the poles of conservatism [i.e., traditions of reading and writing] and technological disruption" (Edmond, 2020, p. 5). Both perspectives on literacy development are without doubt commendable, though strangely imprisoned in their respective disciplinary field that they try to break out from. The former leans on a relatively uncritical imaginary regarding reading and writing code as a supreme means for problem-solving, which will supplant traditional forms of reading and writing. The latter is more reflective regarding how core skills in the humanities, such as reading and writing, can adopt and integrate technological development. Vee (2017) and Edmond (2020) observe an obvious relationship and convergence of practices between reading and writing code vis-à-vis text. Nevertheless, neither of the perspectives manage to forge a pathway for a balanced discussion across technology and the humanities, regarding reading and writing of the future. This persistent divide was also formulated by Haas (1996) who observed that a narrow view of technology's role and function in society excluded humanities perspectives from technology discourses:

> As long as technological theory and practice are guided, even determined, by a discourse in which technology is an agent and history is a cycle of technological revolutions, then the role of scholars and teachers, especially those in the humanities, will be minimal. Granted it may be difficult, given the present division of labor, to envision a world in which humanists take an active role in designing and implementing technology (Haas 1996, p. 199).

Hayles' (2005) analysis of coding language in relation to Saussure's and Derrida's language views is among the most serious attempts to understand how reading and writing can be approached as equally dependent on both figuration and action. However, on a concrete hands-on level, reading and writing text is about the surface and mimicking human language and communication among humans. The coding, in turn, is operating at deep and hidden levels, and is defined in Fang et al. (2022) as a:

> […] complicated cognition activity […] involving comprehending a problem and converting it into a computational task, designing the procedure to complete the task in the form of a flowchart, determining data structure by referring to programs with similar tasks, developing abstract program patterns, representing the patterns with the syntax of computer programming language, compiling the computer program into computer codes, and testing and debugging the generated computer codes (Fang et al., 2022, p. 1302–1303).

Texts of the postdigital era are endowed with multifold layers of both text and code activities, which leads to inquire whether we are observing a new evolutionary stage of reading and writing, adding to developmental stages of writing technology that Avrin (2010) describes in her historical work. Changing views of literacy skills, such as reading and writing, have consequences for how these activities are situated and learnt in education.

The flow of comments and critique that Snow's (2012) Rede lecture on *The Two Cultures and the Scientific Revolution* has given rise to does not seem to stop (see Tredell, 2012; Collini, 2013; Cheville, 2022). He addressed a problem that is still discussed, namely how cultures of scientists and of intellectuals are contributing to societal advancements, and how education seems to have been "designed to channel people into one culture where they often loose the ability to interact with, or even show interest in, cultures other than their own" (Cheville, 2022, p. 96). In 2019, Walter Massey, Chancellor of the School of the Art Institute of Chicago, and Chairman of the Giant Magellan Telescope Organization, writes that:

> […] if Snow were to resurface today he would be pleased at the progress that has been made in bridging the two cultures. Although there are still gaps to be closed, and new divides have emerged that I suspect would not please him (Massey, 2019, p. 68).

Massey draws attention to that highly educated people of today can very well discuss topics across disciplinary boarders, which scholarly discourses on reading and writing text and code bare witness of. However, the question is if public education systems mitigate a stereotypical framing of scientific culture as "heroic, optimistic, moving forward, and active" (Cheville, 2022, p. 96), while the humanities culture is framed as "reflective, traditional, blind to changes wrought by technology, and incurious" (Cheville, 2022, p. 96). Snow observed that education rather contributed to deepen the divide between the two cultures. The implementation of programming in Swedish compulsory school will in the following form an example of how knowledges and skills in a domain that concerns all areas of society raises questions of how "the two cultures" are perceived of in today's education.

Situating reading and writing code in the Swedish school system

Against this backdrop of blurring of lines between different disciplinary purposes and practices of text production, it is worthwhile trying to (re)situate reading and writing in a computational era, and to tease out what education can be expected to deliver regarding reading and writing literacies across science and the humanities. This is particularly urgent, since, as argued by Williamson et al. (2019), programming and coding are concepts that have been hi-jacked by stakeholders outside education, promoting their own agenda

summarized by concerns for national competitiveness in the global economy. Williamson et al. (2019) explore how the implementation process of computer science and programming curricula world-wide have generated fluid boundaries between educational policy-making and commercial actors, such as the software industry. Diligent lobbying actors outside the schooling context orchestrated a "high-speed policy-making" (Williamson et al., 2019, p. 720) that never considered how reading and writing code could be merged with textual comprehension and production.

Programming, was decided to enter the Swedish curriculum in 2017 (Vinnervik, 2021), and "announced as being integrated into existent curricula of math, technology, language and social science, and implemented by schools in mid-2018" (Williamson et al., 2019, p. 716). The transnational prelude to this premiere of exceptionally fast curriculum implementation has been thoroughly analysed in Williamson et al. (2019), why this study concentrates on the aftermaths of this opening date.

In the following, we will undertake a discursive analysis of one of the most forceful instances through which Swedish education is communicated, that is, the Swedish School Agency. The exploratory approach that guides the study adopts two main analytical lenses. One strand is occupied with how programming and coding is communicated in the public school arena, and another strand observes emerging intersections between the humanities and computer science, particularly between practices of reading and writing. These approaches are intertwined in the analysis, serving the purpose to narrow in on specific moments of reading and writing where practices and disciplines collide, while preserving the relation to broader themes in society with regards to programming and coding in education. The findings will lead up to a discussion of our research question of "how programming and coding can be orchestrated in education to break with the outworn dichotomy between the 'two cultures'" (Snow, 2012).

In the analysis of policy and steering documents, the main keywords used to capture the problem are the following: "coding," "programming," "digital literacy," "digital competence," and "digitalization." In the section below, discursive elements that point to how programming is conceived of and valued are highlighted in an analysis of the Swedish curricula and policy documents related to digitalization and education.

Situating coding through Swedish steering documents and curricula

The national digital strategy for schools (*Nationell digitaliseringsstrategi för skolväsendet*) was approved in 2017 by the Swedish government (Swedish Ministry of Education, 2017). The strategy has pointed at three focus areas: digital competence for all, equal access and use, as well as research and follow-through for digitalisation. The national strategy is focusing on digitalisation and education on an overall level, including digital management of educational services. Programming has not received any protruding position in the document and can be considered a sub-dimension and integrated in the goal of offering digital competence for all. Nevertheless, the word "programming" appears already in the first section of the national digital strategy, stating the need for knowledge *about* programming, not necessarily *in* programming:

> All children and pupils need to be offered possibilities to understand how digitalization influence the world and our lives, how programming steer information flows that reach us and the tools we are using, as well as possibilities to acquire knowledge about how the technology functions, in order to be able to apply it (Swedish Ministry of Education, 2017, p. 3, our translation).

The word 'coding' is not present in the document, and the concept of 'digital competence' is preferred to 'digital literacy', which can be considered a synonym of the former. Though, the difference between these concepts resides in that "literacy" implies competences that "spread beyond a specialized class of citizens" (Vee, 2017, p. 150). In line with this view of literacy, the national digital strategy stresses the need for developing all pupils' skills "to find, analyze, critically evaluate, and create information in different media and contexts" (Swedish Ministry of Education, 2017, p. 6, our translation). A proof of that these skills are targeting a literacy aspect rather than a specialized competence is reinforced by the fact that they are inscribed, though slightly differently formulated, in the curriculum for the Swedish subject of upper secondary school, wherein literacy skills traditionally are acquired. In the description of the Swedish subject the aim is precisely to develop skills in "navigating, reading, selecting, and communicating in a broad digital text world with interactive and changeable texts" (Swedish School Agency, 2022, our translation). This corresponds fairly to the digital competence in the national strategy quoted here above.

Thus, literacy emerges as an aspect of digital competence, that, according to the national strategy, also includes the aspect of "how digital technology can be used," and how to "create tools and solutions with the help of digital technology […]. It can, for example, be about programming knowledge" (Swedish Ministry of Education, 2017, p. 6, our translation). Hence, the digital competence addressed in the national digital strategy encompasses both traditional literacy skills that have been extended and augmented through the digitalization of society, and the technological aspect, targeting the creation and relevant uses of digital tools, without making a clear distinction between these two aspects. As we shall see, this integrated conceptualization of digital competence is altered through the operational documents in the curricula.

The Swedish curricula was released in 2011, revised in 2018, and published in a new edition in 2022. We have here mainly used the English version from 2018. The curricula include upper secondary school, compulsory school, preschool class, and school-age educare. The curricula describe the overall goals and set out the norms and values and the knowledge that all pupils should acquire during their schooling. The documents address overall goals, supplemented with the syllabus for each subject, school stage and school form. The basic structure for each subject is that the aim of the subject is described first, followed by the core content, and ending up on knowledge requirements for different grades.

In the curricula, digital competence is fractionalized so that skills in programming and the creation of tools and solutions with digital technology (digital know-how) appear in the subjects of technology and mathematics, while other subjects do not mention programming at all, while stressing the digital literacy aspect. The civics subject forms an exception from this rule, since programming is mentioned in the part that describes the core content for year 7–9:

> Different types of media, their structure and content, such as the different parts of a newspaper. How individuals and groups are portrayed, e.g., on the basis of gender and ethnicity, and how information in digital media can be controlled by underlying programming (Swedish School Agency, 2018, p. 231 English version).

This rather precise description of how programming becomes embedded in social sciences, and a means to support learning in the main subject, contrasts with the formulation in the Swedish subject for upper secondary school. The Swedish subject underscores more broadly how to "communicate in digital environments with interactive and changeable texts" (Swedish School Agency, 2022, p. 6, our translation). This formulation could very well be interpreted as including how programming is formatting and framing texts and communication, aiming at supporting the understanding of the main subject, as in civics. Hence, it seems somewhat paradoxical that programming is in this way obscured in the Swedish subject, but not in civics, while language subjects offer foundational literacy skills that scholars currently relate to reading and writing code. Though, it is notable that the term "programming" in the civics subject has disappeared in the 2022 version of the Swedish curricula, which further underscores how reading and writing code are situated at a distance from the humanities and social sciences.

Programming within the subjects of mathematics and technology is worthwhile closing in on, since these formulations reveal more precisely how programming is intended to be learnt and for what purposes. In mathematics and technology, programming is mentioned in the text that describes the aim of the subject and in the core content for year 1–3, 4–6, 7–9. For example, it is stated in mathematics that pupils should be offered opportunities to learn "how algorithms can be created, tested and improved when programming for mathematical problem-solving" (Swedish School Agency, 2018, p. 60 English version). In technology the programming know-how is geared towards "pupils' own constructions in which they apply control and regulations, including with the aid of programming" (Swedish School Agency, 2018, p. 299, English version), and towards "controlling objects by means of programming" (Swedish School Agency, 2018, p. 297, English version).

While programming in mathematics and in technology are described both as a tool for problem-solving, and an aid to understand the main subject, programming is also described as an important separate area of technology, through the learning content of "controlling objects by means of programming" (see above). This formulation corresponds to growing research literature on learning programming through robotics in early education (see the literature review by Çetin and Özlen Demircan, 2020). Both subjects describe programming in the core content in all years, showing a progression in this field.

Even though programming is clearly integrated in the subjects to enhance different problem-solving activities focused on mathematical problems and technical construction problems, programming is not an explicit part of the description of the knowledge requirements. This framing raises questions regarding how programming knowledge is implemented. Is this an optional knowledge content for those who are interested in this specific area, but not requiring a grade? The syllabus (age 7–9) in mathematics expresses that:

> […] pupils should be given opportunities to develop knowledge in using digital tools and programming to explore problems and mathematical concepts, make calculations and to present and interpret data (Swedish School Agency, 2018, p. 55 English version).

The quote shows that the teaching design should offer opportunities to develop programming knowledge and skills, which does not necessarily imply that pupils learn to code and are graded on these skills. These ambiguities in the steering documents seem to play out in the classroom, as Humble (2022) shows in his interview study with Swedish K-12 teachers in mathematics and technology. The results show that programming activities are mainly carried out through introductory unplugged programming and block programming. The purposes of the activities are summarized as introducing elements of play into the teaching and learning, as well as enhancing motivation and encouraging exploration of the subject specific area. Teachers agree on that textual programming tools, that clearly address reading and writing code for the purpose of human-machine communication, are difficult to use in the classroom. The reason is that the teachers do not have enough competence in the area (see also, Misfeldt et al., 2019), and the progression is more difficult to control in comparison to pre-made programs for learning code. However, teachers do acknowledge that textual programming allows for "deeper understanding and easier use of mathematical calculations because the tools are freer" (Humble, 2022, p. 4898), and they envision textual coding activities in future learning settings (Humble, 2022).

Discussion

Apparently, the Swedish school seems yet to lack a readiness to orchestrate the digital literacy skills that Vee (2017) and Edmond (2020) formulate as textual skills in reading and writing code, and that can be applied to a multitude of purposes in society. Programming in mathematics and technology is rather focused on mathematical problem-solving and technological constructions, hence, on subject-specific knowledge, while coding literacy stretches to all areas of society, including social sciences and the humanities. On the contrary, in social sciences and the humanities in the Swedish curricula, if programming even is mentioned, it is never addressed as a tool for problem-solving within a specific subject, only as a support to understand a knowledge specific area. If coding encompasses reading and writing skills of the future, it will most probably not be sufficient to apply programming as a tool within mathematics and technology, as is currently the case in Swedish curricula and teaching learning practices. The consequences of pursuing this pathway need to be considered. Firstly, programming tends in this way to be entrenched in engineering disciplines, which is already the case according to Vee (2017), leaving other fields of use for programming to drop behind. Secondly, engineering education is dominated by male students and marked by a masculine culture (Secules, 2019), which can function as excluding specific groups, for example females, from freely exploring and acquiring skills in reading and writing code. Thirdly, digital cultures that are transforming all sectors in society, including education with its range of subjects and disciplines, seem to encompass the outworn dichotomy between science and the humanities, catering for interdisciplinary approaches to problem-solving. The framing of reading and writing code in Swedish school settings is rather opposite to this evolution, since curricula display a

tendency to isolate programming skills within engineering disciplines, such as mathematics and technology. However, the national digital strategy for school does not divide digital competence into disciplinary specialized knowledge, even though the analysis has shown a distinction between digital literacy, which builds on traditional literacy, and digital construction and comprehension of digital technology.

Turning to neighboring countries, such as Denmark, the Danish Ministry of Education's *Action plan for Technology in Education* (2018) formulates a more inclusive vision focusing on that:

> all children, adolescents and adults not just use the digital technology – they should also be able to relate critically to and shape this technology. Everyone does not need to become ICT specialists, but children, young people and adults should be able to commit themselves to digital communities and develop 21st century skills including "ICTcreativity" and "digital literacy" (Storte et al., 2019, p. 12).

The main difference with Swedish policy document emerges through the mention of "ICTcreativity," which allows for using programming as a tool in a range of subjects, not only in technology and mathematics. The explicit formulation regarding general ICT knowledges and skills also caters for a reflection on digital literacy as non-specialized competences, that should, according to Vee (2017) and Edmond (2020), include reading and writing code. Within the Danish school perspective, framing programming solely through mathematics and technology thus seems counter-productive for implementing digital literacy pertaining to programming.

The challenges to engage with reading and writing code across disciplines and school subjects are, nevertheless, undeniable. As the UNESCO report *Coding, Programming and the Changing Curriculum for Computing in Schools* underscores: "integrating Computer Science/Informatics across other subjects in school curricula has been ineffective" (Storte et al., 2019, p. 3), mainly referring to experiments with separate programming curriculum in the United Kingdom. Instead of letting such past failures prevent explorations of implementing reading and writing code across subjects in school, Sabuncuoglu (2020) identifies precise obstacles to this development. For example, the author states that "various resources have been designed to teach AI, however, these resources generally fail to meet an interdisciplinary approach and do not narrate the overall picture of AI development" (Sabuncuoglu, 2020, p. 96). To distinguish points of improvement to conceive of and practically work with programming in school across subjects seems crucial for bridging 'the two cultures' in future education. This is a position in scholarly research that seems to gain ground, which is reflected in Altin et al. (2021) study, where they precisely claim that programming needs to be acquired through different subject areas:

> Programming helps facilitate students' examination of the nature of a problem and helps students to increase their computational thinking, problem-solving and higher-order thinking skills through the combination of multiple disciplines in areas such as science, the arts, engineering, and mathematics (Altin et al., 2021, p. 183).

In this quote, the authors make an explicit point of why and how programming encompasses the 'two cultures'; on the one hand, technology and natural science, and, on the other hand, the humanities and social sciences. The conditions for realizing this inclusive take on reading and writing code in school are yet to be elaborated, especially in the Swedish context, where the framing of programming in policy and steering document seems to cement rather than overcome the C. P. Snow gap. A study by Thompson and Childers (2021) on fifth graders who use the programming tool Scratch to create stories, shows new pathways towards learning storytelling by means of computation. The results indicate that the literacy learning was twofold, including programming skills and storytelling skills. In the Swedish context, initiatives to work with text and code simultaneously would need teachers with different expertise to partner up and collaborate to reduce divides that current practices of programming implementation in school tend to establish.

This preliminary result regarding programming literacy in the Swedish school context needs to be supplemented with data from other powerful instances of communication than policies and steering documents, such as the daily press and the academic arena. A comparative analysis of how reading and writing code is addressed and positioned within other mediating instances of education will contribute to further understand the local–global conditions for pro-active initiatives that could frame programming as a literacy skill that augment and extend traditional literacy skills of the past. If coding is the new way of participating in the shaping and writing of the world it cannot be confined to some narrow areas. The scholarship that this article is departing from rather suggests that coding should be viewed as language, which is required in Swedish curricula as a dimension within all subjects, a position that is expressed and exemplified in Bergh Nestlog and Fristedt (2016) anthology, *Språk i alla ämnen för alla elever* [Language in all subjects for all pupils]. A comprehensive view of the conditions and conceptions of coding in different impactful and communicative instances will offer clues to how academic disciplines and school subjects can create a variety of ways to engage with reading and writing code as a literacy dimension of the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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