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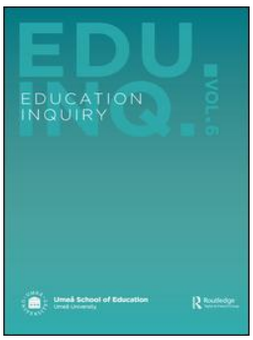

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Eva Wennås Brante & Robert Walldén

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"Internet? That's an app you can download". First-graders use linguistic resources to describe internet and digital information

Eva Wennås Brante and Robert Walldén

Department of Culture, Languages and Media, Malmö University, Malmo, Sweden

ABSTRACT

Given young children's frequent use of the internet and the expectations formulated in policy documents such as the Swedish national curriculum, teachers need to promote critical awareness about information found online, even in the earliest years of schooling. Responding to the need for more information about how first-graders understand the internet, we report on findings from focus group interviews concerning what students in Grade 1 think the internet is and what kind of experiences and linguistic resources they draw upon to express their understanding. Based on thematic and systemic-functional linguistic analysis, the results show that the children mostly express an understanding of the internet as something concrete, such as an app, as something encapsulated in apps or hardware and, more generally, as an enabler for the use of different apps. Students connections to using YouTube and games are prevalent, and their understanding of the internet is shaped by experiences of screen interactions when using these apps. On rare occasions, students hesitantly tried to formulate abstract perspectives concerning what the internet is or what it means. Possible directions for promoting and researching a more abstract understanding in pedagogical practice are discussed.

KEYWORDS

Critical literacy; first-graders; focus-group interviews; internet; linguistic resources

Introduction

It is telling that surveys of internet use no longer ask whether individuals use the internet or not, they ask how frequently individuals use it (Danovitch, 2019). For example, we learn from the Pew Research Center (2020) that 80% of children age 5 to 11 use or interact with a tablet computer and that 53% of the parents asked reported that their child aged 11 or younger watches YouTube videos daily. A similar scenario emerges in a study of children in 19 European countries (Smahel et al., 2020). The latter study reports that a majority of the children have access to smartphones and thereby almost constant access to internet. The study also describes that two-thirds of the children in the 19 countries watch videos on a daily basis (Smahel et al., 2020). In Sweden, where the present study is conducted, an annual report on internet use

CONTACT Eva Wennås Brante eva.wennas-brante@mau.se Department of Culture, Languages and Media, Malmö University, 20506, Sweden

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(Andersson, 2019) gives further evidence of most school-starters being daily internet users, whose activities include searching for information and doing schoolwork online.

While these young children from all over the world are only in the very beginning of their schooling and in the development of their reading skills; they still encounter a plentitude of information which they have to both understand and evaluate. We argue that a prerequisite for the critical examination of online information is an understanding of what the internet is and how information reaches the internet (Bråten, Brante, & Strømsø, 2019). Furthermore, in the digital age, awareness of how the internet works, and how the information found there is far from neutral, but rather shaped by power relations and specific intentions, is of crucial importance to the development of critical literacy (cf. Janks, 2010, 2013). Consequently, there is a growing body of studies investigating how children *understand* what it means to "be online" or use the internet (Mertala, 2019). Established definitions of internet describes internet as a global information system logically linked by unique addresses enabling communication and information sharing (Leiner et al., 2009). The information system is not "touchable" and invisible for children (and most adults). To gain perceptual knowledge of the internet, children can interact with internet via a screen, mouse, or keyboard (Bordoff & Yan, 2017)- However, the interaction and the sensory input in these instances are limited. Children playing with toys and things connected to the internet via applications have another opportunity to gain perceptual knowledge of the internet. Still, the lack of visual information of how, for example, data from toys reaches an app, does not fully support children in grasping established definitions of the internet. Recent inquiries into children's understanding of the internet demonstrate how children aged 10–16 years conceptualise it as a network of two or more computers, a giant search engine or possibly even a big central computer (see for example Buchanan & Murray, 2018 or Edwards et al., 2018). Younger children (5–8 years) mention more mechanical or visible features such as wires or the need for electricity in order to access the internet (Edwards et al., 2018), or perhaps that the internet is needed to download games (Oliemat, Ihmeideh, & Alkhawaldeh, 2018).

Purpose and research questions

There is clearly a need to support young children in understanding what it means to "be online", what the internet is and how information reaches the internet, in order to then be able to evaluate said information. As previously stated, access to such knowledge is a prerequisite for developing critical awareness (cf. Janks, 2013). Teachers need to build on students' present understanding if they are to act as agents of inclusion and social justice (cf. Pantić & Florian, 2015). This raises two important questions that have guided us in this study: What do students in Grade 1 think the internet is, and what kind of experiences and linguistic resources do they draw upon to express their understanding? Answering these questions is a necessary point of departure for further explorations of how first-graders can develop skills crucial to negotiating and assessing information they find online. With this paper, we add to previous research by employing linguistic analyses which not only show *what* the children say about the internet but also *how* they phrase their responses. By foregrounding ways of talking about the internet, it will be possible to gain insight into different perspectives relating to the

need for promoting young children's critical awareness about the information found online, through teaching activities and classroom discourse. Our aim is that the qualitative understanding provided by this study serve as a point of departure for further research and interventions.

A continuing interest in children's understanding of the internet

New technological phenomes implemented in schools draw interest from researchers, as for example when computers started to be of use in schools (Cuban, 1993) or later, when the cell phones became ubiquitous (Thomas, O'Bannon, & Bolton, 2013). It is thus not surprising that over the last twenty years, researchers have had an interest in investigating children's understanding of the internet and information retrieval, especially in the years since schools started to go online (Luckin, Rimmer, & Lloyd, 2001). Initially, secondary school students were focused on in research, but later studies (e.g. Eskelä-Haapanen & Kiili, 2019; Mertala, 2019; Yan, 2005) also include six-year-old children as participants.

Age, according to Yan (2005), is a factor in children's conceptual understanding of what the internet is; the older the child, the better the understanding, even though far from all participants (n = 111; 83 children and 28 adults) in Yan's study could explain the internet in a correct way. One possible explanation may be that the younger the children, the more filtered and regulated their internet use. Thus, with less experience, the children have fewer possibilities to understand the function and construction of the internet. However, Yan (2005) was able to conclude that adults' understanding of the technical features of the internet was sparse, as only 2 out of 28 adult participants had what Yan defined as a "correct understanding" of the internet. Yan refined and replicated his study in 2009 when the internet had been available for more years and found that "all participants (n = 786; 105 adults and 681 9- to 17-year olds) in the study showed limited understanding, essentially "perception-based or perception-bounded knowledge about the Internet" (p. 109). Yan's result suggests that interacting with the internet is not sufficient for developing a more advanced understanding of the phenomena. Ten years after Yan's study, Eskelä-Haapanen and Kiili (2019) interviewed 30 children aged 7–9 years regarding their understanding of the internet, both as a technical and a social environment. The authors were also interested in exploring how the children perceived the trustworthiness of online information. Age was shown to impact the answers in this study as well; the children who were unable to give answers, or believed everything on the internet to be true, were all first-graders.

When talking to children about how they understand the internet, later research has found that how questions are asked to children in interview studies play a key role in shaping their conceptions (Mertala, 2019). For example, if concepts such as "programming" are introduced by the interviewer in the beginning of the interview, it is possible that children re-use this concept, despite not being familiar with its usage. One way to avoid such priming is to use a combination of drawings (e.g. asking children to draw what a computer/the internet is or how it works) and then complementing the drawing task with interviews (Mertala, 2019, 2020; Yan, 2006). When Mertala (2019) investigated five to seven-year-old children's understanding of the internet, he asked the participants (n = 65) to draw pictures of how they thought computers work and

which parts they are composed of, subsequently using said drawings as the starting point for his interviews with the children employing the "draw and tell conversation method". The questions Mertala used to probe children's understanding of the internet were similar to those used in our study. Mertala asked, for example, what is the internet and how does the internet work? Interestingly, more qualified perceptions of what the internet is and how it works seemed to be, according to Mertala's findings, based on problems with internet connections. Children who had experienced different breakdowns in internet access had also become more aware of what an internet connection is and the prerequisites of a working connection. At the other end of the spectrum, Mertala argues that a very smooth and effortless user experience, such as with intuitive smart phones, results in the notion of being online or offline becoming an opaque phenomenon for children (and even adults).

Another aspect of importance, concerning children's understanding and thoughts around internet, has to do with the origin of the information children meet when using media. Yan (2009) points out the difference between, for example, TV-shows and what can be found on a computer screen: TV-shows are broadcast by an organisation and have been subjected to some form of censorship or gatekeeping, whereas on the internet, individuals can and do operate without any safety mechanisms at all. A child's screen, be it a computer, a tablet, or a smart phone, is connected to billions of other computers or senders of information. Buckingham (2015) highlights the richness built into children's use of internet during leisure time; children find images, they find fuel for their imagination and means of self-expression and they may use their devices as "a medium through which intimate personal relationships are conducted" (p. 22). Further down on the children's list, information retrieval is found. This activity seems to be perceived as school related. Buckingham argues that educators need to engage with the whole repertoire of children's experiences with technology and the internet, and, importantly, provide their students with a means of understanding these digital practices – especially as children also interact with "things" or toys connected to the internet (Danovitch, 2019) – things that may collect data during play or in the use of apps (Selwyn & Pangrazio, 2018). When children grasp the differing digital practices and understand the ideas behind internet, they are better equipped to assess the credibility of all kinds of retrieved information.

Lately, the prevalence of voice interfaces (voice search in Google) and conversational agents (e.g. Siri and Alexa) have made information retrieval on internet accessible to children before they can read and write (Lovato & Piper, 2019). The only prerequisite for posing a question to the internet is to formulate a sentence and speak clearly. However, Lovato and Piper found, in a study from 2015, that children do not fully understand what the system can and cannot answer, which sometimes leads to frustration. Lovato and Piper (2019) argue that a factual answer from the system might not always be the best alternative. When children communicate with adults and ask questions, adults often respond with "what do you think, what do you already know". Such answers, encouraging the children to hypothesise and make connections to previous knowledge, have a positive impact on a child's language development and expand their use of linguistic resources (e.g. Halliday, 1975; Painter, 1984).

Today, research around children and internet often concerns dangers occurring from the use of internet, for instance game addiction, insufficient safety, or cyber bullying. Our

research interest has another departure point: how young children cope with the information they encounter on the internet. As mentioned in the introduction, we argue that a prerequisite for critical examination of online information is an understanding of what the internet is and how information reaches the internet. Lately, there has been a call for studies merging reading instructions and plausibility judgements as asking oneself *Is this explanation plausible, and how do I know?* (Sinatra & Lombardi, 2020). With this study we want to contribute with research responding to the "how do I know"- part by carefully studying how first-graders express their understanding of the internet and discuss the implications for fostering a critical awareness of information encountered online.

Theoretical framing

In this section, we outline the theoretical framework employed to understand the thoughts expressed by the children regarding the internet.

In sociocultural and sociological theory, different terms have been used to describe the difference between understandings arrived at through immediate experience and those arrived at through the more formal thinking associated with schooling: Vygotsky (1986) contrasted spontaneous concepts with scientific concepts, while Bruner (1986) made a similar distinction between narrative modes of thinking dependent on particular experiences and a principled paradigmatic mode. Inspired by Durkheim's dichotomy of the sacred versus the profane, Bernstein (2000) has compared segmented and context-dependent *horizontal* discourse with the explicit, symbolic knowledge structures constituting *hierarchical* discourse.

As we intend to explore children's understanding of the internet through their use of spoken language, we have turned to Systemic-Functional Linguistic theory (SFL). As noted by Wells (1994), Halliday (1993/2004) has made a distinction similar to that of Vygotsky and Bruner by comparing common-sense everyday grammar with elaborated written grammar. Seminal studies in systemic-functional linguistics (e.g. Halliday, 1975; Painter, 1984) show how young children, through interaction with adults, expand their meaning-making resources in order to express knowledge of abstract concepts through language. Our analysis also draws inspiration from Legitimation Code Theory (LCT) (cf. Martin, 2013; Martin & Maton, 2017; Maton, 2014). A theory closely connected with SFL and Bernstein (2000), LCT proposes the term *semantic gravitation* to explore the degree in which discourse is context dependent. A strong semantic gravitation denotes discourse reporting on, for example, observable events and actions, while *weak* semantic gravity points to more general or abstract principles and ideas. This notion of semantic gravity is useful as it makes it possible to escape the dichotomies described above and to explore discourse in terms of varying degrees of abstraction. In earlier studies, LCT has primarily been used to analyse the negotiation of knowledge in classroom discourse (e.g. Macnaught, Maton, Martin, & Matruglio, 2013; Nygård Larsson, 2018; Walldén & Nygård Larsson, 2021), and will therefore see a novel application in this study. The operationalisation of SFL and LCT in the present study will be presented in the analysis section

Methods

Our intention was to explore children's perceptions of the internet and their understanding of the origins of information through the way the children express

themselves in words. Our starting point was therefore to ask children questions about the internet and pay close attention to how they phrase their explanations. Our study has a novel approach, as we focus on the children's use of linguistic resources (cf. Halliday, 1975; Painter, 1984) to comprehend their perceptions of the internet (see further below).

Interviewing young children differs from interviewing adults in several respects: for one, children in our target age group (seven-year-olds) may have a less developed understanding of abstract concepts and also, depending on their home environment, may be more or less used to using resources of language to express abstract ideas (cf. Bernstein, 1972; Halliday, 1975; Heath, 1983; Painter, 1984). Therefore, it is the adult interviewer's responsibility to formulate questions about theoretical concepts in a language possible for most children to understand and use (Shapiro, 1991). For this reason, we took precautions in our study to adapt the language in our set of questions. Firstly, we presented our questions to a teacher of children in the same age group. Her feedback prompted us to re-phrase some of our questions to adapt them to the age of the interviewees. Secondly, we performed one pilot interview with an eight-year-old child. The experiences gained in this interview led us to formulate more concrete and relatable introductory questions, such as what experiences they have of using tablet computers at home and in school. In light of the pilot interview, we also chose to bring a tablet computer as a recognisable artefact on which to base our communication (discussed below).

According to Kortesluoma, Hentinen, and Nikkonen (2003), open-ended questions are preferred when interviewing children, as they allow children to describe what they think and understand in their own words, "thus eliciting their subjective frame of reference" (p. 435). Given that we wanted to explore children's subjective understandings of the internet, we therefore designed our interview questions as open-ended questions.

Participants

We used our networks to find teachers who were willing to put us in contact with their students. One of us had already established contact with a school (School A) through on-going field work. After sending out a few emails, we established contact with a teacher at another school (School B), in another part of the same city. Both teachers taught first-graders, which, in the Swedish system, refers to seven-year-olds. Parental permission was gathered at both schools and 23 students volunteered to be part of the interviews. The interviews did not touch upon sensitive topics and children were interviewed in groups, thus we waived to ask consent from an ethics committee. From School A, 12 children participated (nine girls and three boys), and from School B, eleven children participated (seven girls and four boys). As is frequently the case in Swedish classrooms, not all of the students had Swedish as their first language.

Procedure

We decided to conduct our interviews in groups of three children, according to the principles of focus group interviews (cf. Brinkmann & Kvale, 2009). Following a looser structure than one-on-one interviews, we found the focus group format conducive to

our aim of encouraging and eliciting a variety of perspectives from the children. This approach also has the advantage of evening out the relations of power between the researcher and the children participating, enabling us to avoid the scenario of one adult "interrogating" one child.

We conducted four group interviews at each school, each with one researcher present. One of the researchers had done some prior field work, mostly as a passive observer, in the class (School A) in which the interviews were conducted. The other researcher conducted interviews at School B with children the researcher met for the first time when performing the interviews. To mitigate this, the researcher visiting School B spent around 20 minutes in the classroom before meeting with groups of children in a group room. All of the students participating in the interviews had announced their interest in participating in the study and seemed enthusiastic and unrestrained in sharing their thoughts and experiences relating to the internet. Therefore, we believe the impact of one of the researchers having done prior field work in the class to be minor. However, the possibility of the students in School A feeling slightly more relaxed and open during the interviews should be acknowledged.

The interviews were performed during the school day in small rooms close to the ordinary classrooms and lasted around 20 minutes (3 hours in total). The interviews were later transcribed (45 A4 pages). We brought tablet computers to use as a conversation starter. We took precautions in formulating the questions around the tablet computer, to avoid priming the students (Mertala, 2019). We showed the tablet and asked, "Do you have one like this and what do you usually do with it?". Knowing that the students used tablet computers in school, we presumed that the tool was familiar to them and also one that mediated an internet experience (In both schools, students had access to tablet computers and/or more "traditional" computers.) The children were interested in the tablet computers, which allowed the interviews to continue with ease. The researcher visiting School A also showed a laptop computer, which was ignored by the students in favour of the tablet. The interview guide covered four themes; how the children find things on internet, what the internet is, if internet is good or bad and if there are any costs related to internet. Some of our questions (seen below in Table 1) involved eliciting discussion topics from the whole group with the students followed up on each other's responses. Other questions were carefully directed to each child in the group to receive a full repertoire of responses.

Analysis

The first stage of analysis was inspired by thematic analysis (Braun & Clarke, 2006), and involved repeated readings of the transcripts and the identification of distinct themes denoting different ways in which the internet was talked about by the students. We made separate readings and preliminary categorisations, which were later consolidated into agreed-upon themes comprising: internet as a (search) app; internet as electricity; internet as an enabler; internet as a phenomenon and internet as something with several meanings. These were later reworked into the subheadings in the result section. Our analysis included both answers to direct questions about what they think the internet is, alongside the children's perceptions of the internet arising from discussions of related topics, for example how to get access to the internet and how content found on the internet arrives there.

Table 1. Interview topics and interview questions.

Topic	Interview questions
Probing questions as conversation starter	What do you usually do with this? [showing tablet computer/laptop] How do you use computers in school? Do you use internet then? For what?
Internet as technical and social arena	How has XX [depending on earlier answer] appeared on the internet? Can you use internet to find out something you're wondering about? What can you find out when you use the internet? Has someone showed you how to search for things on the internet? Follow up: Who? When? How? What do you think internet is, really? Where is the internet?
Pros and cons with internet	Do you think internet is a good thing? Tell me! Do you think internet can be a bad thing? Tell me!
Economical intrests	Is there something that cost money on the internet? Who gets the money if you buy something on the internet? Does anyone get money when you … [depending on answers above]

The second stage of analysis adopted the perspectives of SFL and LCT and was conducted in order to reach a deeper understanding (within the themes) of the perceptions of the internet expressed by the students. We had a particular interest in their use of *material* and *relational* processes (Halliday & Mathiessen, 2014). Material processes are verbs representing different actions and events. In the present study, these processes contributed information not only about how the students described their active use of digital devices and the internet, but also about how they perceived the functioning of the internet, for example how it could be used on digital devices or actions required for connecting to the internet. Some relevant examples from the material are *press* and *download*. Relational processes, on the other hand, are used for the purposes of definition and description, constituting important resources for communicating and developing abstract knowledge (cf. Christie, 2002; Halliday, 1989/1993; Walldén, 2019). Vygotsky (1986, s. 192) has noted that the development of scientific concepts starts with verbal definitions. In the present study, the use of relational processes concerned, for example, what the internet *is* and what it *means*. The use of these processes showed which attributes and definitions the students ascribe to the internet. As for LCT, the concept of *semantic gravity* was used to determine if the students expressed a context-dependent view of the internet based on their everyday experiences of using it for different purposes, or if they conveyed more abstract and general ideas about the internet as a wider phenomenon. Also, the analysis will point to students' use of other resources of language central to describing their perceptions of the internet. This includes the use of logical connections to explain what the internet is and the use of evaluative resources of language to describe attitudes towards the internet (cf. Martin & Rose, 2007; Walldén, 2020).

Excerpts from transcribed interviews have been translated from Swedish to English by the authors, in a way which preserves the linguistic categories and constructs in our analysis. As several of the participants do not have Swedish as their first language, our translations also preserve some traces of learner language.[1] In the transcripts, students ("S") are numbered 1–23. The added letter ("A" or "B") denotes the school in which the interview was conducted. The numbering of the students participating in School B is tentative as it was not always possible to separate the voices (the children being less

familiar to the researcher, as discussed above). The letter "R" denotes "Researcher". Omitted discourse is represented by "/ … /", interruptions by "–".

Limitations

We acknowledge some limitations of our study. In comparison to one-on-one interviews, focus group interviews reduce the possibilities to probe for individual answers by eliciting exemplification and clarification. We recognise this as a limitation to the study offset by the advantage of getting multiple perspectives at an exploratory stage, thereby hopefully laying a foundation for further enquiry and intervention in research. The use of tablet computers as artefacts can be seen as problematic as it could have affected the students' perspective on the questions asked about the internet. However, we believe the students apparent familiarity and enthusiasm for the tablet computers contributed valuable discursive data about how they view and use the internet, strengthening the overall results. As mentioned above, students in School A were also presented with a laptop computer which did not generate the same response. Finally, it should be acknowledged that some students with Swedish as a second language might have found it easier to express their thoughts in their first language. However, we did not perceive that the few discernible traces of learner language was an obstacle for the students' contributions. For ethical reasons, no specific information about students' language backgrounds was collected.

Findings

In this section, we present our findings. Firstly, we will show how the first graders often talked about the internet in concrete terms as part of everyday experience. Secondly, we will explore their attempts to formulate more abstract perspectives on the internet.

Perceptions of the internet as part of everyday experience

Our analysis shows that the students talked to a large extent about the internet as something which enables the use of different apps and games, which can be exemplified by the following excerpt.[2]

Excerpt 1

R: Look, if a little old man came here, from another planet, or a little guy from another planet, an alien which never had been here on Earth, and did not know what a computer was, and so on, what would you tell this guy what the internet was, what would you say? /…/
S19B: I don't know.
R: It's a really tricky question, isn't it?
S19B: That internet, you can like play on it and look at movies.

R. Säg så här, om det kom hit en, en liten farbror från en annan planet, eller en liten figur från en annan planet, en utomjording som aldrig hade varit här på jorden, och inte visste vad en dator var, och så, och så skulle ni berätta för den gubben vad internet är, vad skulle ni säga då? /…/
S19B. Jag vet inte.
R. Det är jättesvårt att svara på, ju.
S19B. Att internet, kan man spela typ på och kolla på film

The above excerpt shows that the student seems to be stumped by the question about how the internet can be described, before answering that it can be used to play games and watch movies. The answer shows a concrete understanding of the internet shaped by the student's experiences of using digital devices for recreation. The perception of the internet as an enabler is prevalent in our material. Further, the students often expressed a view of the internet as something which can be seen or directly interacted with, and something which is contained in hardware or apps. Recurring themes connected to this concrete understanding of the internet will be explored in the coming sections.

Engaging with internet through screen interaction and visual cues

On several occasions, the students talked about the internet as something which can be seen. In the excerpt below, the researcher had engaged the students in talking about how things, like YouTube videos, come to the internet.

Excerpt 2
S23B: There's something which greens up, it's something more which comes from the YouTube, a green which says the internet is with us and it's red it says well it isn't with us.
R: Ok, so you can like see it.
S23B: Yes.

S23B. Det är någonting som grönar upp, det är något till som kommer från youtuben, det kommer en grön som säger internet är med och den är röd den säger ja internet är inte med
R. Mm. Så man kan se det liksom
S23B. Ja.

The student expresses that one can use visual cues to establish the presence of the internet in uploading a video to YouTube. Similarly, a student described how to connect to the internet, in a comment elaborating on a discussion about how to get good internet access.

Excerpt 3
S1A: Maybe because you can put like an app /…/ which is like a key that you can get inside and then there's just a button you can press and then you wait until the button gets blue. Then you can watch YouTube or so.

S1A: Kanske för att man kan lägga typ en app /…/ som är som en nyckel som man kan gå inuti och sen bara finns en knapp man trycker och sen väntar man till knappen ska bli blå. Då kan man kolla på Youtube eller så.

The student describes the material processes involved in connecting to and using the internet: *getting inside* ("gå inuti") a key and *pressing* ("trycker") a button. Like in the previous excerpt, the student also mentions colour as a visual cue and, in this case, the word "app" seems to be a substitute for "icon". A similar understanding is reflected in the below excerpt.

Excerpt 4

S2A: Internet is like such as this and it's like lines and you press it and there it says like internet in [street name] so you can press it and you get internet there.

S2A: Internet är typ en det är en sån här och det är typ strecker och man trycker på det och sen så står det som internet i [gatunamn] så kan man trycka på den och så får man internet där.

The student's attempt to discuss attributes ascribed to the internet, achieved through a relational process (Halliday & Mathiessen, 2014), shows the prevalent difficulty of putting the idea of the internet into precise words: "Internet is *like such as this*" ("Internet är *typ en det är en sån här*"). The student then proceeds to describe visual information in wordings like "lines" ("strecker") and "says like internet" ("står det som internet"). The material process *press* ("trycka") is used to refer to screen interaction. As in previous excerpts, the student shows an understanding of the internet shaped by experiences of screen interaction and sensory information.

Responses regarding visual cues also occurred when the researcher directly asked the students if the internet can be seen. In the below exchange, the topic is how games can be put on the internet.

Excerpt 5

R: Can you see the internet then?
S16B: Yes.
R: How?
S16B: You just see a small spot, then you press it, a square.
R: Oh, you mean on the computer, right? Or the iPad.
S16B: Yes, anything. iPad, computer, phone.

R: Kan man se internet då?
S16B: Ja,
R: Hur då?
S16B: Man ser bara en liten plutt, så trycker man in på den, en fyrkant
R: Aha, du menar på datorn alltså, eller på Ipaden.
S16B. Ja, var som helst, Ipad, dator, telefon.

The student uses *see*, a mental process of perception ("ser"), *press*, a material process ("trycker"), and specifies that the internet can be seen in this way on different devices. As in previous examples, this shows how the students talk about the internet as something concrete, that is something which can be seen and something which can be manipulated by pressing on a screen. The semantic gravity in the perceptions formulated by the students is strong.

Internet as an app

In relation to the previous category is the perception of the internet as an app, which is illustrated in the below excerpt where the researcher asked where the internet is.

Excerpt 6
R: Where is the internet? /…/
S18B: Well, it's an app.
R: That you can click on. Do you think so as well? Where is the internet? Where could it be? *Where* is it?
S18B: I don't know. On a computer.
R: But how does it. So, it is always in the computer or the phone?
S18B: No, you have to download it to have it because you have zero apps when you get the first phone or computer or iPad.

R: Var finns internet? /…/
S18B. Alltså, det är en app
R: Som man klickar på. Tänker du också så? Var finns internet? Var finns internet någonstans *Var* finns det?
S18B. Jag vet inte. På en dator.
R: Men hur kommer det. Finns det alltid i datorn eller telefonen då?
S18B: Nä, man måste ladda ner för att kunna ha det för man har noll appar, när man får den första telefonen eller datorn eller ipaden.

Using *[i]s*, a relational process ("är"), the student explicitly describes the internet as an app and hesitantly locates it as being "on a computer" ("på en dator"). When the researcher wants to know how the internet arrives there, the student explains that you must download it because there are "zero apps" ("noll appar") on devices to start with. The use of the material process *download* shows an understanding of internet as something concrete which you can acquire through interactions with various devices.

Another student described the internet as an app used for searching. Before the following exchange, the students have played with the researchers' tablet computer and used the Google app to search for pictures of a line of toys.

Excerpt 7
R: But if you think of it like this. Now you have used the internet. You have searched for things. But what is the internet, really? What is it? What are your thoughts?
S7A: A search app where you can search.
R: You can search. /…/ But that which you search for on the Internet, how did it get there?
S8A: I know I know. When you write or say it on the speaker. Then it gets there.

R: Men om man tänker så här. Nu har ni använt internet. Ni har sökt på saker. Men vad är internet egentligen? Vad är det för nånting? Vad tänker ni på?
S7A: En sökapp där man kan söka.
R: Man kan söka. /.../ Men det man kan söka på internet, hur har det kommit dit?
S8A: Jag vet jag vet när man skriver eller säger det på högtalaren. Då kommer det dit.

The first student (S7A) describes the internet as "a search app where you can search" ("en sökapp där man kan söka"). Marking one of few instances where the internet is associated with searching, this response is likely grounded in the student's immediate experience of using the Google app on the researcher's tablet computer to look at pictures of a particular line of toys.

The student's assertion that the internet is a search app is followed by the researcher asking how the information gets there. Another student (S8A) enthusiastically offers that it gets there "when you write or say it on the speaker" ("när man skriver eller säger det på högtalaren"). Thus, the information found when searching is equated with the user's input. The student's comment further illustrates how their perception of the internet is shaped by their immediate experiences of interacting with digital devices. Rooted in these experiences, the perceptions articulated by the students once again indicate a strong semantic gravity.

The view of the internet as an app for searching was voiced more elaborately by another student, S10A:

Excerpt 8
R: What is the internet really?
S10A: Can I explain?
R: Tell me your thoughts.
S10A: Yes, I think it is an app where you can go into different stuff and like well. Find out what you don't know and find out what you do want to know.
R: Can you see the app here? [shows tablet computer screen]
S10A: Yes, there's the internet if the internet is like Google but well yes. If you mean internet in that way.

R: Vad är internet egentligen?
S10A: Får jag förklara?
R: Du kan säga vad du tänker.
S10A: Ja jag tror att det är en app där man kan gå in på olika grejor och typ ja. Få reda på det man inte vet och få reda på det man vill veta.
R: Finns den appen här? [visar ipad-skärmen]
S10A: Ja, internet finns ju om internet är typ som Google fast man ja. Om du menar den internet

The student asking the question "Can I explain?" ("Får jag förklara?") indicates a desire to present himself as knowledgeable about the internet. Marking a rare occurrence in the material, the student's more elaborate description associates the internet with the function of retrieving unknown or desired information. Being of a more general character than ones discussed above, the semantic gravity is weaker, reflecting a more abstract perception. Also, the internet is not merely equated with a search app. When asked if he can see the internet app on the researcher's tablet computer, the student identifies the Google app but also states that the internet is "like Google" ("som google"), opening up for the possibility that the functionality can be achieved through different apps. He also qualifies his statement with "if you mean internet in that way" ("om du menar den internet"). This indicates a more complex, polysemic view of the internet which will be explored more fully below.

Internet as something encapsulated in apps or hardware

The students enthusiastically talked about how they used tablet computers and other tablets for recreational purposes, like playing games and watching video clips. When asked, the students expressed awareness of internet access being a prerequisite for many of these activities. When doing so, they frequently talked about the internet as something contained in the apps or hardware. This is exemplified below:

Excerpt 9

R: Do you use the internet when you are playing Nomp[1]?
Sx3: Yes.
R: How do you know that you use the internet?
S22B: Because it is, there already was internet in the computers.
R: Ok. Do you use the internet when you watch YouTube too?
S22B: Yes. Because without the internet you can't watch the videos so you it shows some letters and says [inaudible].
S23B: Yes, and some games you have don't need internet, you can play those.

R: Använder ni internet när ni spelar Nomp?
Sx3 Ja
R. Hur vet du att du använder internet?
S22B: Därför det är, det var redan internet i datorna
R. Okey. Använder man internet när man tittar på youtube också?
S22B: Ja. För utan internet kan man inte titta på videorna så då visar det några bokstäver och säger [ohörbart]
S23B: Ja och några speler som man har behöver inte internet, dom får man spel.

One of the students, S22B, uses an existential process, "it is, there already was" ("det är, det var redan"), to locate the internet "in the computers" ("i datorna") and seems to describe the information screen displayed when there is no internet access: "shows some letters" ("visar det några bokstäver"). This also illustrates how the students frequently talked about the internet as an enabler, something which makes it possible to do the things you want with the devices (though not required in all cases). Very similar thoughts are expressed in the excerpt below.

Excerpt 10

SA4: I have lots of games which has the internet but sometimes I'm going somewhere they don't have any internet and then I can play Minecraft. /…/
SA5: I know what needs the internet really. YouTube!

SA4: Jag har jättemånga spel som har internet men ibland ska jag nånstans där dom har ingen internet så kan jag spela Minecraft. /…/
SA5: Jag vet vad behöver internet verkligen. Youtube!

However, in this case it is the games which were perceived as "having" ("har") the internet.

Here, "the internet" is, through a relational process, constructed as an attribute of the games played by the student (SA4). The internet is seen as something games can "have" or "not have". Another student, SA5B, enthusiastically offers YouTube as something which "needs really" ("behöver verkligen") the internet, echoing the previous excerpt. In cases like this, *need* figures as a circumstantial relational verb which construes the internet as something which games, apps and videos depend on (Halliday & Mathiessen, 2014, p. 294).

Excerpt 11
S10A: But you use the internet all the time. Play Roblox or watch YouTube. Because those games must contain the internet for you to play them.

S10A: Men man använder internet hela tiden. Spelar Roblox eller tittar på Youtube. För dom spelen måste innehålla internet för att man ska kunna spela dom.

In the below excerpt, S10A uses the, in everyday speech, less frequent relational verb *contain* ("innehålla") to express the necessity of the internet to play games.

The choice of relational verb, combined with *must*, construing high deontic modality ("måste"), a generic *you* ("man") and *because*, a causal logical connection ("för"), denotes a more authoritative, expert-like voice compared to those in S10A's previous extracts (cf. Martin & Rose, 2007; Walldén, 2019). Still, the understanding of the internet seems shaped by the student's concrete experiences of using

Excerpt 12
S10A: Well, you just download YouTube and then there you have both Internet and YouTube.

S10A: Alltså man bara laddar ned Youtube och sen har man både Youtube och internet där.

apps and games. This is further evident later in the interview, when the same student asserted that the internet is something one downloads along with YouTube.

This view of the internet as something contained in the apps and games used by students, further underscored in the short extract above, gives further evidence of the strong semantic gravity present in most of the students' articulated perceptions of the internet.

Excerpt 13
R: But if you think, what is the internet really, I mean what is it? How would you describe it?
S2A: For example … Internet is like … /…/ That the Internet is a special thing, isn't it, so you can use it for many things. You can use the internet for–
S3A: You have the internet for Google.
S2A: Not *just* Google.
S3A: But one of the things.

R: Men om man tänker, vad är internet egentligen, alltså vad är det? Hur skulle ni beskriva det?
S2A: Till exempel att ... Internet är typ ... /…/Att internet ett speciell sak eller hur så man kan faktiskt använda internet för många saker. Man kan använda internet för–
S3A: Man har internet till Google.
S2A: Inte *bara* Google.
S3A: Jamen en av grejorna.

Students expressing abstract thoughts about the internet

There are some instances when the students attempted to formulate more general or complex thoughts about the internet. One such instance is shown below.

The hesitant use of *for example*, a comparing logical connection ("till exempel"), and a relational clause ("is like … ", in Swedish: "är typ … "), as well as general wordings such as "a special thing" ("ett speciell sak") shows S2A's attempt to state more generally what the internet is. This is indicative of an attempt to convey a perception with weaker semantic gravity. When another student (S3A) breaks in with "you have the internet for Google", S2A contradicts with "not just Google". Thus, the student is not satisfied with giving just one example of how the internet is used.

Excerpt 14
S2A: It is like the internet is really good because this is what's its name like something there is loading and you load it first and then it comes, and you can watch it. If you want to get internet. The internet is created for a guy or I don't know how it was created.

S2A: Det är typ internet är riktigt bra för att det här är vad heter det det är typ nånting det finns laddar så man laddar det först och sen kommer det och man ska titta på. Om man vill få internet. Internet är skapat för en kille eller jag vet inte hur den skapa.

Later in the interview, the same student makes another attempt to describe the general characteristics of the internet.

The student uses "is really good", a relational process, to express appreciation of the internet ("är riktigt bra") and attempts an explanation of how information is retrieved through first "loading" ("laddar") and then "watch[ing]" ("titta"). She also uses a relational process to say something about how the internet "is created" by someone ("är skapat"). The student uses lots of imprecise wordings indicating that she lacks the knowledge and linguistic resources to convey her thoughts more completely: "like something there is" ("typ nånting det finns"), "a guy" ("en kille"), and the deictic us of "it" ("det"). On a third

occasion, unfortunately interrupted by the unanticipated entry of a cleaner, the student also expresses that "Internet is actually a really famous thing you can know on" ("Internet är faktiskt en riktigt känd sak som man kan veta på"). This marks another general appreciative evaluation of the internet, indicative of a weaker semantic gravity.

Excerpt 15

S10A: If you mean such internet that you need for watching YouTube, we never use that. We are not allowed to watch YouTube.
R: Do you mean in school or at home?
S10A: Yes, in school. But if you mean such internet that you can find things on, I use it sometimes to find pictures. On mother tongue [lessons] we work quite a lot with making books in the iPad and things like that. So, we find pictures all over the world on YouTube, well on the internet.

S10A: Om du menar sån internet som man behöver för att titta på Youtube så använder vi aldri det. Vi får inte kolla på Youtube.
R: Menar du i skolan eller hemma?
S10A: Ja, i skolan. Fast om du menar sån internet som man ska hitta grejor på det så använder jag det ibland för att hitta bilder. På modersmålen så jobbar vi ganska mycket med att göra böcker på Ipad och sånt. Så hittar vi bilder över hela världen på Youtube ja på internet.

As also discussed in a previous section of this article, another student, S10A, expressed more complex thoughts about the internet by referring to how it can be associated with different meanings. The researcher had asked the children how they use the internet on a tablet computer or ordinary computer.

The student, S10A, uses the relational verb "mean" ("menar"), which, as it refers to the question the researcher worded, is metalinguistic (cf. Halliday, 1980/2004, p. 234), calling attention to the different ways the internet can be understood or talked about. Using expanded nominal groups, he qualifies the meaning of the internet in two different ways: "such internet *that you need for watching YouTube*" ("sån internet *som man behöver för att titta på Youtube*") and "such internet *that you find things on*" ("sån internet *som man ska hitta grejor på*") (qualificator in italics). As the student articulates an awareness that the internet can be perceived in different ways, the formulated perception has a relatively weak semantic gravity. However, the hedged description given by the student is explicitly related to everyday experiences of using the internet and digital devices. It underscores the overall findings of this article: that the students largely seemed to lack the experiences and linguistic resources needed to talk about the internet in more abstract ways.

Discussion

Overall, the findings show that the students, when expressing their thoughts about what the internet is and how information gets there, drew on rich empirical experiences of using the internet. Similar to Buckingham's (2015) conclusions, our analysis shows that these experiences largely involved using the internet for fun and as a means of self-expression. The results show that the students' thoughts about the internet were heavily

based on immediate experiences of screen interaction. However, the students seemed to have very limited capabilities for *talking about* the internet, something which can likely be attributed to the workings of the internet being less explicit in the apps and services used by the students, such as YouTube, games and Siri (cf. Bordoff & Yan, 2017; Mertala, 2019). The students were, on the other hand, found to frequently bring up *talking to* the internet through the use of conversational agents as Siri or Alexa.

As a contribution to existing research, we have also shown how the students clearly express the idea that the internet is encapsulated in apps and hardware, though not in a way which reflects a more abstract understanding of what the internet is. This is in line with Eskelä-Haapanen and Kiili's study (2019) where students also had difficulties expressing where and what the internet is. Similar to Mertala's (2019) findings, our study indicates that experiences of issues relating to internet access (such as a shortage of data allowance or loss of service) may be an important factor in shaping young children's ideas of how the internet works. Once again, however, the ideas expressed by the children participating in this study reflect concrete experiences of using devices and apps rather than a more abstract understanding, something which also seemed to be the case when students on rare occasions attempted to formulate more complex ideas about the internet as a phenomenon to be evaluated or a resource for gathering information.

Thus, an overall finding of the present study is that the students expressed segmented, context-dependent thoughts about the internet which can be attributed to horizontal rather than hierarchical discourse. While it might be tempting to attribute these findings to the young age of the participants, the understanding expressed by them very likely reflects how adults – including teachers – and older siblings talk about the internet (cf. Yan, 2009). Certainly, in Swedish, it is very common to talk about an internet connection as "having internet" or "not having internet". Given that students encounter and process abstract knowledge of different kinds even in the early years of schooling (cf. Walldén, 2019, 2020), there seems to be a great potential for enriching their understanding relating to the internet and the information which can be found there, thereby laying a foundation for critical literacy (Janks, 2013). We argue that the theoretical lens used in this study shows a possible step forward. If the students receive the opportunity to talk about the internet in more abstract ways in formal schooling, their understanding would likely be enriched, transcending the limitations of merely perceiving the internet through screen interaction (cf. Bordoff & Yan, 2017). Teachers are advised, as a first step, to observe their own explanations and wordings when explaining what the internet is and how it works, to ensure that every-day, relatable wordings are paraphrased in more abstract and general ways. Then, teachers may arrange instructional activities for their students; through meaningful interaction and activities where information is retrieved, contrasted, and discussed. This could also involve using, contrasting and discussing different ways to engage with the internet, such as through tablet computers and laptop computers, the latter likely promoting the use of written language rather than speaking with virtual assistants. In this way, it should be possible to gradually weaken the semantic gravity and arrive at more qualified perspectives of how the internet works and how information found on the internet can be analysed critically. Affording students such opportunities is crucial for equity and democratic participation in society. Also, as in all teaching, it is a desirable goal that students are given the opportunity to "leap up further from the concrete base of each

text or their own experiences to reach more abstract principles" (Maton, 2007). We believe that interventions directed at achieving a more abstract and critical understanding about information on the internet are a fruitful direction for further research.

Notes

1. However, it should be mentioned that several traces were impossible to preserve in the translations. Examples includes non-standard choices of gender and declinations of nouns, reflecting complexities which are pertinent in learning Swedish but not English.
2. Swedish excerpts are shown underneath the English translations and quoted within brackets.

Notes on contributors

Eva Wennås Brante is an Associate Professor at the Faculty of Education and Society, Malmö University. Her research interests are in information search, digital reading, reading comprehension, sourcing while reading of multiple documents and online inquiry. Recent research has targeted how to promote upper-secondary school students' critical reading and learning in the 21st century information society but also how pre-service teachers understand and define the concept of digital competence.

Robert Walldén is an Associate Professor at the Faculty of Education and Society, Malmö University. His research in discourse-bridging interaction and literacy practices in second-language education has been reported in journals such as *Linguistics and Education*, *L1-Educational Studies in Language and Literature* and *Scandinavian Journal of Educational Research.*

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ORCID

Eva Wennås Brante http://orcid.org/0000-0003-1923-4328
Robert Walldén http://orcid.org/0000-0002-2565-8875

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