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# Meaning-making in fifth-graders' multimodal texts: Towards a vocabulary of semiotic potentials in different modes

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*Despite a growing body of research on multimodal writing, scholars still express a need for formal frameworks for discussing multimodal literacy practices and call for research on multimodality in education that develops a vocabulary to approach multimodal texts in teaching. This study answers this call by presenting an analysis that adds to the field of multimodal writing research, and thus furthers the knowledge of different semiotic potentials of modes in student-produced texts. Drawing on a social semiotic approach to multimodality, a total of 299 texts, written by fifth-grade students from three schools in Sweden and Finland, are analyzed. The aim is to explore semiotic modes used in the student-produced written texts. The guiding research questions are: (1) What modes are used in the texts, and (2) what meanings are realized through the different modes in the texts. Results showed that six different modes were used to realize meanings in five categories: create representative meaning; visualize phenomena and assignments; foreground important areas; design the text; and decorate the paper. These categories offer a vocabulary that can describe semiotic potentials of the modes and how they realize different meanings in multimodal texts. Such a vocabulary can aid teachers in cultivating, supporting, and assessing students' multimodal writings that contain multiple modes. From these results, we suggest that acknowledging the diversity of the modes and their meanings in student texts can help raise the awareness of how students also make meaning in modes beyond writing and image.*

*Keywords:* multimodal writing, semiotic modes, meaning-making, student text, social semiotics

## 1 Introduction

This study sheds light on different semiotic potentials of modes in student-produced texts. Meaning-making through the use of different modes is increasingly accentuated and often set as a requirement in education (Rowsell & Walsh, 2011), and educational researchers worldwide highlight that students need

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to have a good grasp of multimodal resources for making meaning (Bezemer & Kress, 2010; Danielsson & Selander, 2014; Kress, 2010). The written mode has long been highly valued in educational settings and recognized as the primary mode that students use for formal learning (Kress, 2010). *Writing* in contemporary society is not, however, restricted to alphabetical, conventional writing; students' written texts also encompass nonlinguistic modes, such as image and color, to name a few. What counts as a mode depends on its meaning-making potential, which is socially and culturally shaped by the environment in which meaning-making occurs (Bezemer & Kress, 2016). A semiotic mode is a pedagogical tool for students' learning, especially since modes tend to appear in combinations. Students' ability to work with multimodal texts is enhanced when they engage in complex decisions about what modes to use when composing texts (Jewitt, 2014). Students' writing is also affected by available resources in the classrooms, and what resources they are allowed to choose in the given teaching situation (Kuby, Rucker, & Kirchofer, 2015). It is, however, choices that form the basis of meaning-making, as the choice and use of a specific mode are always motivated (Kress & Selander, 2012). In the current study, we establish what counts as a mode based on the meaning it makes in the analyzed texts, as well as on Kress and van Leeuwen's (2006) three metafunctions of visual grammar.

### *1.1 Previous research on multimodal writing*

Integrating multimodal compositions in the classroom has been proven to enhance students' writing skills (Vandommele, Van den Branden, Van Gorp, & De Maeyer, 2017), augment traditional school writing (Nash, 2018), and engage and empower students (Smith, 2014). Bearne and Wolstencroft (2007) maintained that developing multimodal classroom environments requires a reviewing of traditional texts. Therefore, gaining an understanding of how students use different modes in multimodal texts is important to inform the teaching of writing. Many scholars have already shown that students use multiple modes and that they demonstrate implicit knowledge of how certain modes can and should be used when they choose and combine modes in their texts (Bearne, 2009; Danielsson & Selander, 2014; Edwards-Groves, 2011; Grapin, 2018; Kuby et al., 2015; Öman & Sofkova Hashemi, 2015; Pantaleo, 2012a; Thomas, 2012). Moreover, in writing assignments with specific instructions, previous research has revealed that students are given space to make modal choices in their writing while still following their teacher's instructions (Hultin & Westman, 2018) and that students sometimes draw images despite receiving no such instructions in the assignment (Björklund, Rejman, Magnusson, & Heilä-Ylikallio, 2016).

A decade ago, Walsh (2011) observed a lack of in-depth analyses of multimodal texts, after which research has broadened the modal scope in multimodal text analyses. Writing has long been suggested to contain generalized and idealized information, whereas images contain detailed and factual complements (van Leeuwen, 1998) as well as clarify, illustrate, explain, and expand the meaning of the writing (Björklund et al., 2016; Sjøhelle, 2013). Previous research has often focused mostly on the uses of and interrelationship between writing and image (e.g., Archer, 2010; Björklund et al., 2016; Sjøhelle, 2013; van Leeuwen, 1998), thus often omitting other modes, such as typography, color, layout, and three-dimensional (3D) objects, even though these have also been addressed in some studies (e.g., Kuby et al., 2015; Pantaleo, 2012a, 2012b; Thomas, 2012). Grapin

(2018) argued that weak versions of multimodality privilege language and use nonlinguistic modes as scaffolds, whereas strong versions acknowledge the essentiality of multiple modes. Nevertheless, writing is not always the main means for meaning-making, especially in digital multimodal compositions (e.g., Dahlström & Damber, 2020; Öman & Sofkova Hashemi, 2015), but also in paper-based texts, which are mostly in focus in this study. Students sometimes choose image and color before writing in their texts (Borgfeldt, 2017) and deem the visual, comprehensive picture as more important than linguistic correctness (Engblom, 2011). Yet, Svärdemo Åberg and Åkerfeldt (2017) found that high school students used linguistic modes for representing knowledge even though they could use nonlinguistic modes. Furthermore, research has shown that typography can serve multiple purposes in students' texts, for example, create moods and narrative links as well as imply sound and other sensory information, and that layout can affect both telling and interpreting narratives (Pantaleo, 2012b). Further, colors can be used to strategically create emphasis, harmony, and variety (Pantaleo, 2012a). Moreover, 3D bodies and materials (e.g., sticks and yarn) are also part of children's multimodal writing (Kuby et al., 2015). Accordingly, like other scholars have noted, we recognize a need to move beyond focus on merely alphabetic text and images to also account for other semiotic modes.

Taken together, despite the growing body of research on multimodal writing, scholars still express a need for formal frameworks for discussing multimodal literacy practices and call for research on multimodality in education that develops a vocabulary to describe and analyze multimodal texts in teaching (Bearne, 2009; Edwards-Groves, 2011; Pantaleo, 2012a; Ryan, Scott, & Walsh, 2010; Yamada-Rice, 2010). Teachers need knowledge about different semiotic modes to cultivate, support, and assess students' multimodal writing and meaning-making (Bearne, 2009; Bearne & Wolstencroft, 2007; Grapin, 2018; Magnusson & Godhe, 2019; Tan, Zammit, D'warte, & Gearside, 2020). Based on a social semiotic view on multimodality and in-depth empirical analyses of students' multimodal texts, this study answers such calls in an attempt to provide a vocabulary of—i.e. a way of talking about—semiotic potentials of modes, useful for describing and analyzing multimodal texts in teaching practices and research.

## *1.2 Aim and context of the study*

This study is part of the research project *The Writing Proficiency Project* (2014–2018), that aimed to study students' (aged 11–19) Swedish writing proficiency in different language environments in Finland[1] and Sweden to support the development of written Swedish language across ages and linguistic backgrounds. Focusing on fifth-graders' (aged 11–12) texts in the present study, we extend the analytical and modal range beyond writing and image, and the aim is to explore semiotic modes used in the student-produced written texts analyzed in the current study. Three schools participated in the project: a school in Sweden (School S); a Swedish-speaking school in Finland (School F); and a Swedish immersion school[2] in Finland (School K). Thus, the context of the study is multilingual, but the intention of this study is not to compare texts written by students with different linguistic backgrounds, but to add to the field of multimodal writing research by furthering the knowledge of different semiotic potentials of modes in student-produced texts. To critically discuss the implications of different semiotic potentials of modes in multimodal writing practices and

research, the study is guided by these research questions: (1) What modes are used in the texts, and (2) what meanings are realized through the different modes in the texts? Our interest is the meanings created through the modes used. We adhere to Halliday and Matthiessen's (2014) definition of text as a "rich, many-faceted phenomenon that 'means' in many different ways" (p. 3), expanding the focus to include language as well as other semiotic resources. Although the material of the study focuses entirely on students' texts, we have a preunderstanding of the context-specific writing processes surrounding the texts in the study since all three contexts were observed during approximately one week by four of the authors. Here, the texts are, however, analyzed without reference to classroom activities (cf. Christie & Derewianka, 2008) and the meanings created in the texts through different modes are the focus of our interest. Thereby, we wish to contribute to the knowledge of children's development of semiotic resources throughout the school years and to provide a vocabulary of semiotic potentials. The meanings are analyzed through the metafunctions of visual grammar suggested by Kress and van Leeuwen (2006; see Section 1.3.1). As such, we do not investigate the students' intentionality in using a certain mode. The study focuses on analyzing modes and the meanings they make independently, as well as how modes interrelate to one another. We wish to contribute with insights that can inform and develop the teaching of multimodal writing by raising awareness of how students make meaning in modes other than writing and image in their texts.

The guidelines and regulations stated in national curricula[3] in Sweden and Finland emphasize that students should create texts with various modes. The Swedish curriculum lists a number of core contents for students at the fifth-grade level and refers implicitly to the creation of multimodal texts by emphasizing that the texts can combine words, images, and sounds (Swedish National Agency for Education, 2011). In Finland, immersion schools follow the same curriculum as other schools but with specific language aims. The curriculum in Finland refers to a broad conception of text implying that "texts are spoken and written, imaginative and factual, verbal, figurative, vocal, and graphic – or combinations of these text types" (Finnish National Board of Education, 2004, p. 44). This suggests that students should both read and write texts created in different media and that the texts may contain different resources for making meaning.

## *1.3 A social semiotic approach to multimodality*

This study uses a social semiotic approach to multimodality as a theoretical lens for studying meaning-making in students' texts. A range of modal dimensions should be considered when dealing with writing (Lillis, 2013). Writing itself includes visual, material, and technological dimensions, and "writing as a phenomenon must always be considered multimodal" (Lillis, 2013, p. 38). In multimodality, typography is viewed as a graphic resource for writing and as an independent mode (see Bezemer & Kress, 2016; Björkvall, 2009; Lillis, 2013; Pantaleo, 2012b). This also applies to layout and color which can be seen as part of visual modes (Kress & van Leeuwen, 2001). Here, we explore color, typography, and layout as independent modes within the visual mode, because of the differences in how they make meaning, how nuanced these meanings are, and how they can realize the metafunctions (Kress & van Leeuwen, 2006) presented in Section 1.3.1.

We use the concept of *affordance* (Gibson, 1986; Kress, 2010) to understand how a mode can or cannot be used in a particular situation; in this case, the student-produced texts. The choice to use or not use a mode is always a matter of materially, culturally, socially, and historically developed ways in which meaning is made. Modal affordances affect what modes are possible to combine and present in specific media, and modes offer both epistemological and pedagogical affordances (Bezemer & Kress, 2008). For instance, words can be written and spoken, whereas images can be displayed. Each mode possesses certain logics. For example, modes bound by the logic of space (e.g., writing and image) have other potentials and limitations than modes bound by the logic of time (e.g., speech and gesture; Kress, 2010).

A multimodal text is not made up of a randomized combination of different modes (Bezemer & Kress, 2016; Kress, 2010; Mavers, 2014). Modes are brought together into a *multimodal ensemble*, in which the modes are interrelated in complex ways and meaning is distributed across modes (Kress, 2010; Mavers, 2014). Some modes can be foregrounded, whereas others can be backgrounded, which determines the multimodal interrelationship (Martinec & Salway, 2005). In multimodal ensembles, the modes can be used to reinforce one another, to fulfill complementary roles, or be hierarchically ordered (Kress & van Leeuwen, 2001). As "each mode can be understood as carrying a particular weight or type of 'functional load'" (Jewitt & Henriksen, 2017, p. 219), we refer to *functional load* when analyzing how meanings are realized differently through different modes in the analyzed texts. For example, writing can hold the major functional load, whereas an image can be complementary by illustrating or complementing the meaning created in writing (Björklund et al., 2016).

Our interest lies in the multimodal meaning-making in the texts, the meaning each mode makes, and the interrelationships between the modes. The meanings are governed by the modal interrelationships in the text as a whole. When analyzing meanings created through different semiotic modes in texts, there are always subjective elements. Thus, we do not suggest that there is only one reading of the investigated texts and that everything is to be found within the texts. Selander (2018) maintained that the meaning of a text comes from an understanding of interpretative interest, the reader's position, and how the text is framed in the situated act of interpretation. In analyzing the meanings of a text, we focus only on the text as such with the interpretative interest apparent in the research questions. Following the tradition in social semiotics to understand meaning-making as situated in social contexts (Halliday, 1978), we consider school as a specific—still highly variable—setting where meaning-making is governed by factors such as assessment and demands of displaying knowledge.

### 1.3.1 Metafunctions of visual grammar as analytical lens

We use Kress and van Leeuwen's (2006) social semiotic approach to visual communication and their three metafunctions of visual grammar as an analytical lens. Figure 1 illustrates the three metafunctions of visual grammar, which are the representational, interactive, and compositional metafunctions. Building on Halliday's (1994) *systemic functional linguistics* (SFL), Kress and van Leeuwen (2006) used the terms ideational, interpersonal, and textual for the three metafunctions. However, the terms representational, interactive, and compositional are often used to avoid mixing the different approaches, as Kress and van Leeuwen (2006) went beyond language in their theoretical framework (e.g., Jewitt & Oyama, 2001).

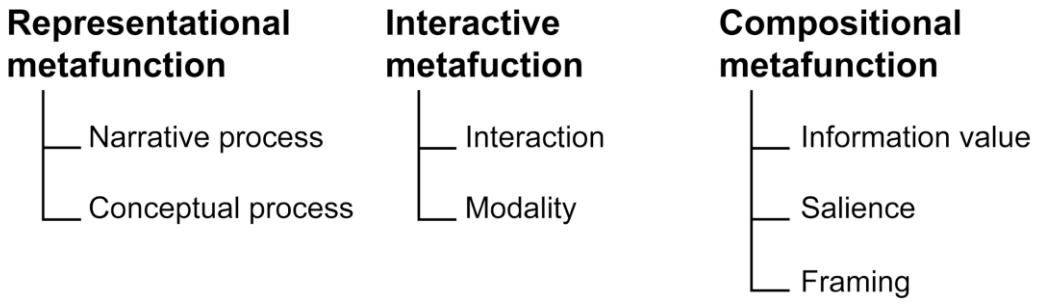



**Figure 1.** Three metafunctions in Kress and van Leeuwen's (2006) social semiotic framework of visual grammar.

The *representational metafunction* addresses how semiotic modes represent objects and how these modes are experienced by humans. Two major processes are recognized within this metafunction, which are narrative and conceptual processes. Narrative processes represent patterns of phenomena and experiences in terms of participants, circumstances, actions, and events, as well as processes of change, whereas conceptual processes represent classificatory, analytical, and symbolic structures. The *interactive metafunction* represents social relations between the producer, the viewer, and the represented object. Interaction includes contact, social distance, and attitude, whereas modality refers to the degree to which a mode represents something to be taken as "true" or "real". Finally, the representational and interactive elements relate to each other in a meaningful whole in the *compositional metafunction*, which includes information value, salience, and framing. Information value is given by the placement of the elements in relation to one another. Salience is the specific way in which elements are arranged to attract attention (e.g., foregrounding an element increases its saliency). Framing then implies marking or delimiting a specific space to establish interest in that space. These three metafunctions operate simultaneously in texts to make meaning, but in line with the textual metafunction in the SFL model (see Halliday, 1994), we take the compositional metafunction to be secondary to the other two. The three metafunctions and their subdivisions include further subdivisions than are visualized in Figure 1 (see Kress & van Leeuwen, 2006).

Even though meaning-making differs in different semiotic modes, there are also similarities. For example, all signs are conventionalized, but the degree of convention is higher in linguistic signs than in signs in other modes. According to Kress and van Leeuwen (2006), the sign-maker's "interest" is the basis for creating and reusing resources as well as for producing signs in images. This suggests that images may also be more or less void of metafunctional meaning and lack functional load. As such, modes may also be purely decorative.

## 2 Material and methods

### *2.1 Material and data collection*

The material consisted of 299 texts. The texts were collected in the aforementioned schools and encompassed 147 texts from School S, 49 texts from School F, and 103 texts from School K. The main inclusion criterion for the texts was that they had to contain alphabetic text written in Swedish. The material was collected for three

to five days from each school in 2014–2015 and contained texts written during the time of the data collection and student texts displayed on the walls of the classrooms. The texts were photographed and the authors (except for the first author) visited the schools and observed instruction in different school subjects. Accordingly, the material was gathered across several subjects (mathematics, music, science studies, social studies, Swedish, and visual arts). The length, content, and design of the texts therefore varied. We are aware that different subjects use modes to different degrees, but we choose to analyze the texts without a subject-specific lens because of the intention to comprehensively address student-produced texts, and out of the interest to understand how meanings were realized at a more abstract level. Hence, our interest was not to analyze the multimodal meaning-making of different school subjects, or to compare subjects. In addition, the media varied: 290 texts were handwritten; 6 were printed; 2 were digitally composed; and 1 incorporated both handwritten and printed components. The texts were written in textbooks and notebooks and on loose paper and computers. Although a majority of the texts were handwritten, we recognized that students used typographic elements in these texts, and this motivated why we chose to regard typography as relevant also in handwritten texts.

## *2.2 Method of analysis*

The analysis was carried out using qualitative content analysis (Schreier, 2012) with an abductive approach informed by the social semiotic lens (Halliday, 1978; Kress, 2010; Kress & van Leeuwen, 2006; Mavers, 2014). The process of analysis was done with open coding, categorization, and abstraction. A thorough reading of all material identified the following six modes used in the texts as a result of the concept-driven coding process: writing, image, color, typography, layout, and 3D objects. The concept-driven coding was based on our choice to regard these modes as independent and the understanding we had about semiotic modes based on the research literature. This stage in the analytical process resulted in Table 1, which shows the fundamental categories of semiotic modes found in the material.

**Table 1.** The characteristics of the analyzed modes.

| Writing | Image | Color | Typography | Layout | 3D object |
|---|---|---|---|---|---|
| Alphabetic text written by students | Images (illustrations, sketches, photos, symbols or emoticons) produced or chosen by the students | The use of colors other than black in writing, images and 3D objects | The use of typographic elements that affect the meaning-making | Elements of graphic design, dealing with arranging visual elements on a site of display | Tangible three-dimensional objects |

After the fundamental categories of modes were identified, the texts were analyzed using NVivo 11 to facilitate open coding of the semiotic modes in the texts. The analysis started with an investigation of all modes in each text separately using Kress and van Leeuwen's (2006) metafunctions of visual grammar as analytical lens. The categorized semiotic modes were, first, analyzed according to the meanings they fulfilled in relation to co-present semiotic modes. This could,

for example, be an image of blood vessels that illustrated the explanation of the blood flow in written text (see Figure 3). Second, the categorized semiotic modes were labelled when different meanings were identified. The labels were reviewed several times to ensure that the coding was accurate.

Table 2 presents a summary of the multimodal ensembles in the empirical material. The intention of the quantification is to provide an overview of the material included in the analysis. Even though we considered typography and layout as independent modes in the analysis, we excluded them from the summary as students always used a certain typography or layout in their writing, but they are not always representational, interactive, or compositional.

**Table 2.** Summary of the empirical material.

| Multimodal ensemble | Mean ($n$ = 299) | | School S ($n$ = 147) | | School F ($n$ = 49) | | School K ($n$ = 103) | |
|---|---|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | Frequency | % | Frequency | % |
| Solely writing | 132 | 44.1% | 75 | 51.0% | 23 | 46.9% | 34 | 33.0% |
| Writing and image | 84 | 28.1% | 45 | 30.6% | 16 | 32.7% | 23 | 22.3% |
| Writing and color | 10 | 3.4% | 4 | 2.7% | 3 | 6.1% | 3 | 2.9% |
| Writing, image, and color | 62 | 20.7% | 12 | 8.2% | 7 | 14.3% | 43 | 41.8% |
| Writing, color, and 3D | 1 | 0.3% | 1 | 0.7% | – | – | – | – |
| Writing, image, color, and 3D | 10 | 3.3% | 10 | 6.8% | – | – | – | – |
| Total | 299 | 100% | 147 | 100% | 49 | 100% | 103 | 100% |

After the accuracy of the coding was confirmed, the codes were interpreted and organized into different categories based on the meanings they made in the text as a whole. During the abstraction process, the categories were compared, and similar categories were merged into joint categories, which ultimately resulted in five categories, with potential subcategories, representing ways of realizing meaning through different modes. The analysis was performed by the study's first, second, and third authors, but it was discussed among all authors. Consistency was also assessed by comparing the coding over time and across researchers. The coding process was performed twice at different occasions by the first author, and cross-checked by the fourth author. Possible differences of opinion were discussed until consensus was reached.

## 3 Results

Using the metafunctions of visual grammar as analytical lens, five categories of realizing meaning through different modes emerged. These were based on which

metafunctional meanings were most prominent as well as on their functional load. The categories were: create representative meaning; visualize phenomena and assignments; foreground important areas; design the text; and decorate the paper. As shown in Figure 2, the most prominent use of the modes was the category of *create representative meaning*, in which the representative metafunction was most prominent even though all metafunctions were used. Overall, all modes carried a more or less prominent functional load when used for creating representational meanings. In *visualize phenomena and assignments*, *foreground important areas*, and *design the text*, nonlinguistic modes were used. These created different kinds of meanings, and all metafunctions were used, but the interactive and compositional metafunctions were the most prominent. Thus, the categories were not mutually exclusive, but rather tendencies, in regard to the used metafunction. In these three categories, the functional load was lower than in the category of create representative meaning. In the category of *decorate the paper*, the modes carried less or no functional load in relation to the whole text, and the metafunctional meanings were weak or nonexistent in relation to the meanings of the text.

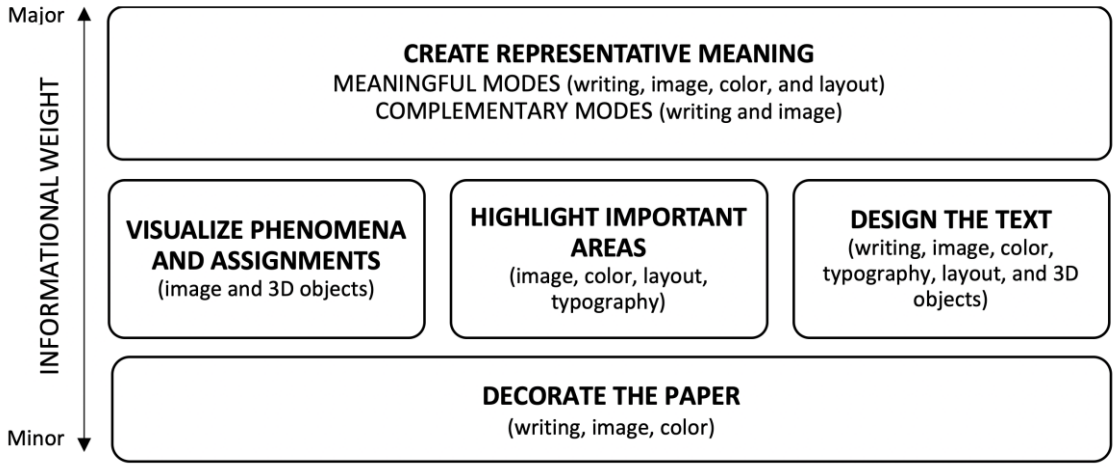
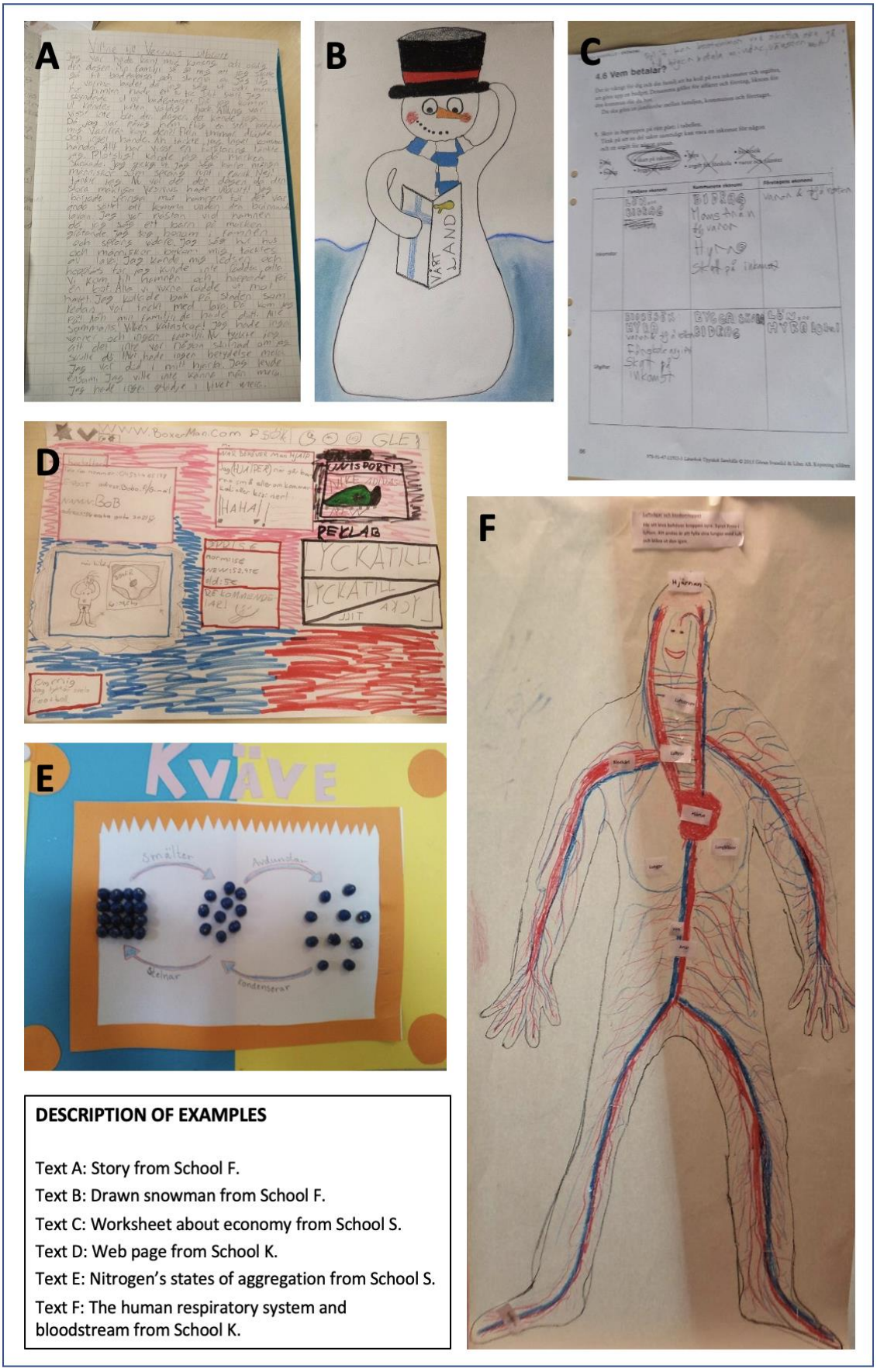



**Figure 2.** Categories of realizing meanings of semiotic modes in the analyzed texts.

Figure 2 illustrates that the category of create representative meaning is the richest and most complex way of realizing meaning, which explains why it is given more space and attention in the result section. For increased transparency, the categories are presented together with examples from the empirical material (see Figure 3). When referring to text examples A–F in the remainder of this section, we refer to Figure 3. Ultimately, we acknowledge that these categories are based on interpretations—they emerged from our subjective interpretative interests in relation to the research questions (cf. Selander, 2018)—and that they do not have fixed boundaries, as is often the case with semantic categories (cf. Halliday & Matthiessen, 2014).

## *3.1 Create representative meaning*

Create representative meaning referred to modes used most prominently for the representational metafunction (Kress & van Leeuwen, 2006) in the texts. However, interactive and compositional meanings were also realized in this category. The modes that created representative meaning (see Figure 2) possessed different narrative and conceptual structures. This category was further divided into two subcategories: *autonomous modes* and *complementary modes*.




**DESCRIPTION OF EXAMPLES**

Text A: Story from School F.
Text B: Drawn snowman from School F.
Text C: Worksheet about economy from School S.
Text D: Web page from School K.
Text E: Nitrogen's states of aggregation from School S.
Text F: The human respiratory system and bloodstream from School K.

**Figure 3.** Collage of text examples from the empirical material.

### 3.1.1 Autonomous modes

Autonomous modes referred to modes that made meaning independently, and modes that needed to be combined with another mode. These modes often carried major functional load, implying that if that specific mode was removed, the meaning would be altered. Creating the entire text solely with one specific mode, for instance, writing, was possible (see Table 2). Writing carried major functional load when the alphabetic text expressed something that was not expressed in other modes. For example, the meaning of the story in Text A would be altered if the writing was removed. Similarly, images as visual explanations carried major functional load when they expressed something that was not expressed in writing. An example was the reading snowman in Text B; removing the snowman would change the narrative meaning. Because of the images' affordances, these meanings were most aptly represented via images rather than by other modes.

The representational metafunction was salient in many of the images in the material. Many of the images included conceptual processes. For example, Text D used images as conceptual processes to describe and render "what is" (Kress & van Leeuwen, 2006) by displaying attributes of the webpage (i.e., telephone numbers and prices) "in terms of their more generalized and more or less stable and timeless essence, in terms of class, or structure or meaning" (Kress & van Leeuwen, 2006, p. 79; cf. relational processes in SFL). In Text D, the interactive metafunction is also visible through humorous interactive elements (i.e., smileys and laughter in uppercase 'HAHA'). Further, images also included narrative processes (Kress & van Leeuwen, 2006). For example, the image in Text B represented a narrative process, involving actions and events of the patriotic snowman dressed in Finnish colors and saluting a leaflet entitled *Our country* (cf. material processes in the SFL framework). Additionally, images, as well as colors, also created representative meaning by making corrections in the texts. An example was the drawing of a cross in Text C, marking that a specific question was already answered.

In the multimodal ensembles, some meaningful modes had to be combined with another mode to create representative meaning. Writing was used to create representative meaning by describing images, but, in the ensembles, the writers chose to combine writing and image. The intended meanings were thus created through the combination of several modes, thus pointing to the interrelationships in the multimodal ensembles. Both writing and image were needed in this case. Writing described the images, and images visualized the writing in an intersemiotic relationship, as the modes created the meaning together in an ensemble (Kress & van Leeuwen, 2006). Accordingly, even if the image was autonomous, it did not independently create representative meaning. An example was the arrows in the text about nitrogen in Text E; the arrows visualize the directions, whereas the writing describes the processes.

Colors could create representative meaning that was expressed in neither writing nor images. However, colors could not create the entire representative meaning independently but had to be combined with writing or images to carry major functional load. An example was how the colors red and blue visualized which vessels were arteries and veins in the text about the human bloodstream shown in Text F, thus carrying an important information load in the representational metafunction, but in combination with the image of the body. The colors' affordances made them suitable for conveying these kinds of meanings. Furthermore, the use of colors affected the modality of texts, i.e. the

degree to which the phenomenon was depicted realistically or super-naturally/non-naturalistically. For example, the flat blue of the water in Text B did not pretend to depict real-world water, just as the strong black line of defining the snowman reinforced the non-naturalistic style of the drawing. It was a matter of different possessive attributes (see Kress & van Leeuwen, 2006) revealing differences between reality and imagination. Another example of modality of colors was the blue and red colors of the blood vessels in Text F, accurately symbolizing the lower temperature of the blood in the veins than in the arteries. At large, the texts often signaled high truth-value, which is a feature that we believe is indicative of the fact that they were produced in school subjects.

Ultimately, the layout of a text could be meaningful and carry a functional load as the layout mediated how the multimodal ensemble should be read compositionally (cf. the compositional metafunction). For example, in Text D, without the navigation bar on the top and the drawn widgets in the center, the text would not necessarily be perceived as a web page. An example of information value in texts, signaling with compositional resources, was marking ownership of an assignment in writing; the major share of the meaning making resources of the text was placed in the center, whereas the names were written in the margins of a paper or on a predetermined line.

#### 3.1.2 Complementary modes

Complementary modes referred to modes that must be combined with another mode to create representative meaning comprehensively. As such, writing was complementary if it could not independently create the entire representative meaning but instead complemented another mode in the multimodal ensemble, and this depended on the affordances of the used semiotic modes. This differed from how writing created representative meaning by describing an image (see Section 3.1.1), because if the image was removed, the writing still created representative meaning autonomously. An example of writing as a complementary mode was the written explanation "close-up" (*närbild* in Swedish) next to a close-up image of a pair of boxers on the web page in Text D. The word close-up did not convey what kind of close-up without the image. The image stood on its own, thus making the writing complementary to the image. As complementary modes, images also created representative meaning by visualizing the text by supplementing or complementing the meaning expressed in writing; therefore, they were complementary. The image duplicated the writing, or vice versa, and created an interrelationship between the modes in the multimodal ensemble. An example of this was the word "boxers" in the close-up of the boxers in Text D.

### *3.2 Visualize phenomena and assignments*

Visualize phenomena and assignments referred to using semiotic modes that made meaning in conceptual processes. For example, when making meaning through symbolic structures in conceptual processes, 3D objects visualized and enlarged reality, as well as visualized assignments. Small colored balls visualized and enlarged 3D atoms in different states of aggregation in Text E. The atoms could be replaced with images, but advanced drawing skills would be needed to capture their three-dimensionality. In this text, all six modes were used and

brought together in an ensemble and contributed to the meaning-making of the abstract phenomena of aggregation. Text E was an example of a text where the affordances of the modes were actively used.

The layout of the 3D atoms in the middle on a white background with an orange frame brought the actual phenomena to the front in the ensemble. In the background, the colors blue and yellow might carry some information about the aggregation states, as well as the visual element in the serrated "icicles" at the top of the inner frame. Text E also exemplified how the 3D objects combined with the arrows (which visualized the directions) and the writing (which gave the literal, physical terms) described the processes to create representative meaning of the abstract phenomenon as a whole. The graphic element of the orange dots in the corners completed the image as a frame.

In visualizing an assignment, quadratic blocks were used as visual learning aids when doing mathematical calculations. Another strategy was to draw images that visualized the blocks. Modes that visualized phenomena and assignments had to be combined with modes that created representative meaning in order to fully comprehend the phenomena or assignments and place them in a context.

### *3.3 Foreground important areas*

Foreground important areas referred to modes that stood out in comparison to the rest of the text by highlighting and determining the interrelationship to other modes in the multimodal ensemble. Like in Text C, images, in the form of framings, were used to foreground important areas and enhance the informational value, such as significant words or concepts, or which optional assignment the student had chosen to work with. Similarly, in Text D, colors were used to underline titles and make framings more salient. Moreover, in Text F, the colors red and blue were used to foreground the blood vessels and show the difference between arteries and veins.

The layout affected how certain areas were foregrounded in comparison to other parts of the text, for instance, by foregrounding and backgrounding images. For example, in Text D, the mode of the image was both foregrounded and backgrounded. The foregrounded image of the close-up of the boxers insinuated greater importance than the man in full view in the background did. Both images created representative meaning, but the interrelations between the images foregrounded an important aspect by suggesting that the close-up was more important in the multimodal ensemble.

Font colors were used compositionally to promote textual cohesion, linking different parts of the text together. Another typographic element that foregrounded important areas was capitalization which was used in titles to increase salience (Text E), and to emphasize important words embedded in body text. By changing the typographic elements, the foregrounded meaning of a text could be altered. An example was a calendar where a student used a bigger font size and capital letters to emphasize "holiday" in "Easter holiday" (*påskLOV* in Swedish). The emphasis was on the word "holiday", accentuating that the holiday was more important than the cause of the holiday. If the word "holiday" had been written with lower-case letters in the same font size as the rest, the meaning would still be the same, but the emphasis on "holiday" would disappear.

### 3.4 Design the text

Design the text referred to modes that made multimodal ensembles more readable and aesthetically appealing, as well as added context and structure. All modes were significant in the design of a text, but in different ways. For instance, layout arranged other modes (e.g., writing, image, and 3D objects), typography affected different meaning-making and the appearance of the writing, and colors added meaning to images and foregrounded important parts in the writing. All modes interacted together in interrelationships when designing the texts as multimodal ensembles.

Designing the text mainly reflected compositional metafunctions in the texts as regards to both readability and aesthetic appearance. Typographic elements, such as different font types and sizes, bold font, capitalization, underlining, and justification in the texts, were used to aid readability. An example, evident in Text A, was clearly separating the title from the body of the text and using underlining and centered alignment. Different typographic elements could also be used to enhance the aesthetic appearance of the multimodal ensemble, like for example, coloring titles and symbols (Text E).

Ultimately, the juxtaposition of the elements within the texts were primarily informed by the layout of the texts in terms of information value (Kress & van Leeuwen, 2006). Different layouts were used to structure the texts using different strategies. One particularly prominent design strategy was the left–right placement in multimodal ensembles. For example, writing placed on the left and an image positioned on the right implied that the reader should start with reading the text and then continue on to the image (see Kress & van Leeuwen, 2006). Other design elements were to use columns, mind maps, and bullet points to structure the multimodal ensembles in the texts. Such design elements affected the framing of the modes, as it structured them in a specific way compositionally.

### 3.5 Decorate the paper

Decorate the paper referred to modes used to fill in empty space on a piece of paper. Such modes did not contribute to creating the primary representative meaning (Kress & van Leeuwen, 2006). Yet, this category could also be perceived as doodling. The distinction between decoration and doodle, however, cannot be drawn without knowledge about the writer's intentions and interest (cf. Kress & van Leeuwen, 2006). When writing was used decoratively, the writing was separated from other, more foregrounded meaning-making resources through its placement in the margins, thus directing information value to the center where the representative meaning was placed. The decorative writing was also often separated from the representative meaning by changing languages, for example to English.

Papers were decorated with images that were not overtly associated with the primary meaning-making resources, for instance, hearts or emoticons. These images were completely separate from the context. For example, in a text in which the writing was about Little Red Riding Hood and Snow White, the image depicted an Asian man dressed in robes. Such images were placed on the left, at the bottom or in the margins, indicating compositionally that the representational information value lied with the writing. Some texts included randomly drawn lines, which might be the result of testing whether a pen worked or possibly an outlet for emotions.

Font colors were used decoratively, but also to foreground certain areas. The precise meaning of the font colors was, however, a matter of interpretation. One could imagine that font colors were used to either foreground or decorate, or the font colors simultaneously foregrounded and decorated the text. Together with font colors, background colors were used to decorate the paper (Text D). When decorating the paper, colors were also used in symbols and emoticons, as in the arrows in the nitrogen text (Text E).

## 4 Concluding discussion

With guidance from our research questions, we explored semiotic modes in student texts and found six modes—writing, image, color, typography, layout, and 3D objects—and five categories of realizing meaning through these modes: create representative meaning; visualize phenomena and assignments; foreground important areas; design the text; and decorate the paper. These five categories emerged through the analytical use of Kress and van Leeuwen's (2006) metafunctions for visual grammar. We propose that these categories can function as a vocabulary for approaching multimodal writing in classroom contexts; knowledge that has been called for in previous research (Bearne, 2009; Edwards-Groves, 2011; Pantaleo, 2012a; Ryan et al., 2010; Yamada-Rice, 2010). In what follows, we critically discuss the different semiotic potentials of modes in the analyzed texts.

Based on the analysis, we argue that these modes and the ways they realize meanings hold semiotic potentials. The results demonstrate that writing holds an important part in the texts, often carrying major functional load and representational meaning. This is not unexpected because the use of written Swedish language was a methodical inclusion criterion in this study. Still, writing is often complemented by other modes to fully create the meanings of the texts. Writing is interrelated with, at least, layout, and its meaning-making is sometimes affected by typographic elements. The written mode can include these elements (Kress, 2010; Lillis, 2013), but our analysis reveals that they can independently affect and change the text, which is also evident in previous research (Pantaleo, 2012b).

Although the vast majority of the analyzed texts were handwritten—bound by the affordances of logic of space, thus limiting the range of possible modes to use—they were noticeably influenced by "digital traits", such as typographic and graphic design elements. The students' handwritten texts often adhered to conventions of digital texts. This indicates that the students are influenced by multimodal writing enabled by screen-based technologies. However, the small number of digital or printed texts in this study is not a limitation but simply a result of the momentary multimodal writing practice observed in the three schools. We recognize that contemporary research on multimodal compositions is increasingly focusing on digital writing (Nash, 2018; Smith, 2014), yet, we still maintain that handwriting will not disappear from the classroom (cf. Bearne & Wolstencroft, 2007).

The results are both consistent with and contradictory to previous studies about the interrelationship of writing and image. The analysis demonstrates how writing creates the primary representative meaning and images complement the writing, like in previous studies (Björklund et al., 2016; Sjøhelle, 2013; van Leeuwen, 1998), but the interrelationship could also be the reverse. In several texts, the image carries more functional load than the writing does, and the writing, in turn, becomes complementary to the image. Agreeing with previous research (Bezemer & Kress, 2010), these results suggest that writing is not always

the main means of making meaning in written texts. Additionally, we perceive that the primary meanings of the texts were expressed in suitable modes, which may be explained by students' implicit knowledge of the modal affordances of modes, which has been demonstrated in previous research (Danielsson & Selander, 2014; Kress & van Leeuwen, 2006; Thomas, 2012).

Four out of five categories (create representative meaning, visualize phenomena and assignments, foreground important areas, and design the text) contributed to the primary meaning-making of the texts, whereas the category of decorating the paper did not. However, all texts did not contain decorations without a connection to the primary meaning, and not a single text contained modes with only decorative meanings. Yet, we acknowledge that the line between design and decoration is very thin and subjective. This result also agrees with previous research within the current project (Björklund et al., 2016), which shows the use of decorative elements in a similar manner. Based on the research in the current project, we recognize that decorations are closely bound to paper-based affordances. However, we cannot draw conclusions about the interpreted decorations without knowledge about the writers' intentions and interests (see Kress & van Leeuwen, 2006). As such, a topic worthy of further exploration could be implications of decorative elements in students' multimodal texts.

This study demonstrates the diverse roles that colors, typography, layout, and 3D objects can have in multimodal texts, thus adhering to research that raises similar arguments (Kuby et al., 2015; Pantaleo, 2012a, 2012b; Thomas, 2012). For example, all six modes were used in Text E, and each mode contributed differently to the multimodal ensemble in the text as a whole (see Section 3.2). Yet, some contexts and writing practices demand the use of several modes to create the complicated and abstract meanings. Using and combining several modes is not automatically desirable but governed by the context and meaning of the text, which is also shown in previous research (Kress, 2010). Nevertheless, rather than perceiving writing and image as semiotic benchmarks in multimodal texts, the current study identifies the value of other modes, all of which contribute with something unique in the texts (see Pantaleo, 2012a, 2012b; Thomas, 2012). Scholars in the field of multimodality have long argued for meaning-making to include more than writing (Bezemer & Kress, 2016; Jewitt, 2014; Kress, 2010), and we argue for a need to raise the awareness of all modes students use in their writings in order to achieve a strong version of multimodal writing (see Grapin, 2018). However, our argument is not that writing and image should be replaced by other modes, which would be impossible as the modes discussed in this study hold different affordances, and, obviously, have different semiotic potentials for complex meaning-making. We cannot ignore the fact that writing has a unique status, but we recognize a need to give more credit to other semiotic modes in educational writing practices. As such, we argue for the value of recognizing the modes found in this study as independent modes because they all held different semiotic potentials in the analyzed texts, and we call for a more balanced approach to different types of meaning-making in written texts. Under these circumstances, all modes have potential value as pedagogical tools in teaching.

As the study is based on material from only three schools, we acknowledge that drawing general conclusions on a broader scale is impossible. Additionally, as this study did not have a subject-specific lens, a possible future study would be to investigate whether the resources are used differently in different subjects and between students with Swedish as a first or second language. Another study

conducted within the current project (Björklund et al., 2016) indicated a quantitative difference between texts written in the different schools because the immersion students produced more images in relation to the amount of texts written, in comparison to students in the other schools. This is also evident in the texts in this study (see Table 2). Furthermore, we acknowledge that students' intentions with using these specific modes would have provided another perspective to the current analysis. The analysis is based on our subjective interpretations, and we acknowledge that the students' intentions in using the modes may be different from what we interpreted based on the written products.

Ultimately, our findings contribute to the discussion on multimodal writing and hold implications for writing practice. Multimodal literacy is emphasized as an important competence to develop in education (Bezemer & Kress, 2010; Kress, 2010), and this study contributes to the research field of multimodal writing by highlighting the diverse use of semiotic modes in written texts. Overall, this study offers a vocabulary that can describe semiotic potentials of the modes and how they realize different meanings. The five categories can be used by teachers to cultivate, support, and assess students' multimodal writings that contain multiple modes. Based on our findings, we suggest that considering the six modes found in this study as separate modes brings an added value to the teaching of writing and creates a strong version of multimodality. Hence, multimodal teaching of writing should favorably acknowledge all modes as pedagogical tools, while simultaneously acknowledging tendencies in multimodal writing within different curricular areas. Taken together, we hope that the results presented in this study will contribute to raising awareness of how students also make meaning in modes other than writing and image in their texts.

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## Endnotes

[1] Swedish is one of Finland's two national languages (the other being Finnish). In 2019, 5.2% of Finland's population was registered with Swedish as their first language (Statistics Finland, 2020). Finland's Swedish-speaking inhabitants are guaranteed education in Swedish as the language of instruction, with the schools separated according to the language of instruction.

[2] Language immersion is a method of teaching in which a person's second language is used as the language of instruction for a major part of the school day (Björklund & Mård-Miettinen, 2011). The immersion students in this study follow an early total immersion program, which means that the Swedish language is taught for 90% of the first grade and then reduced gradually to 50% in the sixth grade (Finnish National Board of Education, 2004). When enrolling in language immersion, the children, with Finnish as their L1, have no knowledge of Swedish. A strategy of one teacher–one language is actualized since the immersion teacher consistently speaks Swedish with the students.

[3] A new curriculum was implemented in Finland in 2016, and the Swedish curriculum was revised in 2016 and 2017. However, as these materials were gathered in 2014–2015, we refer to earlier curricula that were current at the time of the data collection.

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