Kristina Danielsson · Staffan Selander

Multimodal Texts in Disciplinary Education

A Comprehensive Framework

Springer

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Preface

The last couple of decades, society has undergone drastic changes, and digital technology has brought about new ways of storing and producing information as well as new ways of communicating. These changes have also changed our views of learning, in ways that have resulted in new challenges for educational practices. Today, technology-enhanced learning is paired with distributed, collaborative, and self-guided learning processes. Examples are mobile learning, the flipped classroom, and web-based dialogues. Such phenomena presuppose so-called 21st Century Skills, skills that entail new demands and competencies for teachers as well as for school management. Therefore, educational research has developed in ways that deal with innovations as well as questions concerning how small-scale developmental projects can be scaled up (e.g., Halverson & Kelley 2017; Lim et al. 2019).

In parallel to this development, texts have gained greater importance in society, and texts are crucial for learning in more or less all school subjects. At the same time, the meaning of "text" has changed. Today an *extended text concept* is used and we talk about texts as *multimodal*. Through this book, we want to highlight a new way of dealing with multimodal texts in parallel to presenting new ways of working with such texts in education.

To be able to read and handle texts involves a lot more than the elementary reading competency to decode letters and words. Instead, text encounters involving new genres, new content areas, or new media imply new ways of approaching and reading texts. For students navigating between different text worlds, this has become more and more important. Also, for some time now, knowledge has been gained about the fact that different subjects' areas use language in different ways (e.g., Halliday and Martin 1993; Schleppegrell 2004). However, not only verbal language (whether spoken or written) differs between genres and subjects, but other communicative resources too, such as images, diagrams, and graphs. Thus, a variety of resources can be subject-specific and result in potential challenges for the novice in the field.

This book is intended for researchers, for teacher education, and for in-service teacher training. The motivation behind writing it has been to provide researchers and teachers with tools that can be utilized for texts in education. For this purpose we have developed a model for analyzing and working with multimodal texts. Also,

we want to highlight how a multimodal focus on texts can support students' making-meaning from texts, at the same time as such a focus can help students build up an awareness about the importance of text design, thus cultivating their multimodal literacy.

Through this book, we want to shed light on the ways that texts can *represent* knowledge in different ways, and how the *interaction between different text resources* can be both a challenge and a support in meaning-making processes. This concerns wordings as well as other resources such as images and various graphic elements. Furthermore, through our model, we aim to demonstrate how teachers can work with texts in ways that can support students' meaning-making through texts, and accordingly to deepen their knowledge in the content area in question. At the end of Part 1 of the book, we will discuss how our model can be used when working with students' text production, and for assessing texts, paying attention to multimodal aspects of the text.

Factual texts, whether paper-based or digital, whether shown on the computer screen or in different forms of applications for tablets or smartphones, are used in all subject areas. Therefore, this book deals with factual texts rather than literary texts, though multimodality can be relevant for such texts, too.

A Swedish version of this book was published in 2014 (Danielsson and Selander 2014) though this version of the book has been thoroughly revised, and in particular Part II, which consists of sample analyses of texts. Most texts in that part have been altered, to include more texts from other languages and cultures than the Swedish.

Stockholm, Sweden   Kristina Danielsson
January 2021   Staffan Selander

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Kristina Danielsson has a Ph.D. in Scandinavian languages and is a Professor of Swedish in Education at Stockholm University, and Professor of Swedish at Linnaeus University, Sweden, where she was a founding member of the Center for Educational Linguistics and the Linnaeus University Center for Intermedial and Multimodal Studies (IMS). In recent years, her research projects deal with literacy in various school subjects, with a special focus on multimodality. On behalf of the Swedish Board of Education, she has written numerous articles for teachers' in-service training and school development concerning reading, writing, and text talk in educational contexts. Together with Kok-Sing Tang from Curtin University, she is founding coordinator of the Special Interest Group *Languages and Literacies in Science Education.* Recent publications are *Global Developments in Literacy Research for Science Education* (with Tang, Eds., 2018) and Textskapande i grundskolan. *Utveckla funktionella textpraktiker* (with Bergh Nestlog, 2020).

Staffan Selander has a Ph.D. in Education and is Professor Emeritus in Education at the Department of Computer and Systems Sciences, Stockholm University. A major part of his research during the last 15 years has focused on designs for and in learning, knowledge representations, and digital learning environments. He has led several international research projects and has also been engaged in smaller projects in cooperation with school communities. He is the founder of the open access journal Designs for Learning. Some of his later publications are *Didaktikenefter Vygotskij— Design för lärande* (2017); *Games and Education—Designs in and for Learning* (with Arnseth, Hanghøj, Henriksen, Misfeldt, and Ramberg, Eds., 2018), *Digital Learning and Collaborative Practices—Lessons from Inclusive and Empowering Participation in Emerging Technologies* (with Brooks and Dau, Eds., 2021), and *Learning as Social Practice. Beyond Education as an Individual Enterprise* (with Kress, Säljö & Wulf, Eds., 2021).

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Part I
Multimodal Texts and Working with Multimodal Texts in Education

Chapter 1
Introduction

Working with texts in deliberate ways is a foundation for supporting students' subject learning, and their potential to demonstrate their knowledge in the subject. Therefore, it is central for all teachers to understand how texts work, and at the same time to be able to support their students' competencies regarding how texts are designed and how to make meaning through texts. Thus, teachers in all school subjects have a responsibility in this regard, and teachers of the mother tongue cannot be expected to be the only ones responsible for developing students' text competencies. Instead, teachers in all subjects need to deepen their own text competence. We hope that this book can be a support in doing so.

Since text is the foundation of this book, and since this concept is used in both everyday language and academic language, this will be our point of departure in the following.

An everyday understanding of *text* could perhaps be formulated as "written words on a paper or presented on a screen". Academic definitions of text include such connotations, but research over the last decades has contributed to a more nuanced understanding of what a text is and how texts work. Therefore, the text concept has been extended in relation to "written words on paper", now including other resources for meaning-making, such as image, speech, gesture, and so on. Each one of these resources can be seen as a text, provided that it corresponds to other aspects of *text*, such as consisting of a delimited message that can be understood in a specific context. Thus, in research and education today, we often deal with what is commonly termed an *extended text concept*.

An extended text concept implies that texts can consist of a variety of communicative resources that form a joint entity. Examples are written words[1] combined with various forms of illustrations, or a spoken text combined with gestures. Such

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[1] In this book we use an extended text concept. Therefore, we try to be clear when referring to written or spoken words in texts—in opposition to e.g. tables, mathematical symbols, etc. Hence, in the following, we use concepts such as "written/spoken words", "writing/speech", or "spoken/written verbal text".

texts are *multimodal*, and they are the focus of this book. We will discuss the term multimodal more thoroughly below.

Since "text" today can involve so much more than just written words, it is important always to make clear how the text concept is used. Here we want to point out that there is no one correct definition of text. Instead, depending on the context or purpose for using the term "text" in a specific situation, the definition can vary.

In this book, we restrict ourselves mainly to analyzing and discussing paper-based or digital *visual* texts, including all resources integrated in these (such as images, animations, or audio clips). Also, our focus is on *pedagogic texts*, that is, texts intended for more or less formal learning situations such as textbooks or Internet resources produced for educational purposes. Of course, texts that have not primarily been produced for educational purposes are also used in schools. We claim that our discussions of multimodal texts, as well as our model for working with such texts, function well for any kind of text. However, there are good reasons to base an exposition like this on texts that are typically used in education. Teachers' and students' oral texts will only be commented on briefly, not because we are not interested in them, or because we find them unimportant, but for delimitation reasons. We will also look more closely at a couple of texts made by students, in order to discuss multimodal aspects of students' text production.

The aim of this book is to provide the reader with an analytical framework for multimodal texts, and to suggest ways of working with multimodal texts in the classroom practice. In Sect. 4.5, *Model for working with multimodal texts in education*, we present a model for working "hands-on" in classroom practices. Based on a number of examples from real texts, we guide the reader through the model, suggesting ways of approaching texts to be better able to note how the texts are constructed, and what might need to be specifically focused on in the classroom. In the second part of the book, the model is implemented on a number of texts from different subject areas and intended age groups as well as from different countries. In relation to these text analyses we also discuss classroom implications.

The selection of texts in the second part of the book has been made with the intent to use the model for a variety of school subjects, and at the same time the texts have been taken from different countries. Apart from Sweden, which is where we live and work, text examples have been taken from other countries, such as Portugal, Singapore, and Chile. The text examples are taken from different subject areas and intended age groups, even though most of the texts are produced for students in upper elementary (grade 4–6) and lower secondary school. Factual texts geared to younger students are usually quite similar to those produced for grade 4–6 students, even though the amount of written verbal text is smaller, at the same time as the illustrations can be less complicated. Therefore, the examples chosen can also serve well for teachers working with students in lower grades. Correspondingly, texts for secondary school students can be seen as parallel to texts used in upper secondary school, even though texts for the later grades will be more demanding.

The majority of the texts are printed textbooks that are relatively widely used in the respective countries. For example, the Singaporean textbooks are obligatory in Singapore, and the Swedish textbooks are books that are relatively widely spread

in Sweden, where each school decides what textbooks to use. The choice to focus on printed media is connected to the fact that printed books are still important in many schools. Also, many of the digitally produced textbooks today are still mainly based on printed versions of the texts, though in the near future we will probably see changes in this regard.

It is important to stress that the kind of close reading we perform in relation to our analyses is not done to draw attention to limitations or negative sides of the texts. Instead, our intention is to point out challenges that can arise in relation to any multimodal text, something which also justifies conscious ways of working with texts in all school subjects.

1.1 Multimodal Texts

As mentioned, an extended text concept is widely used today, and more and more researchers and teachers are embracing such a text concept, understanding that all texts are multimodal, that is, they are composed of a variety of sign systems, or semiotic resources, such as words, diagrams, graphs, photographs, or various kinds of symbols (e.g. Kress and van Leeuwen 2006, also see Berge 2001, for a discussion on the text concept). It is also common to use various kinds of graphically marked text objects, such as headings or ingresses. Web pages, magazines and the daily press are filled with such resources. Particularly in educational texts, there is an abundance of graphically marked text objects for different purposes, such as text boxes and bullet lists.

Thus, a number of features make texts multimodal, not only the inclusion of images. The layout and the ways in which different parts of the text carry meaning, is also important to understand. Potentially, any part of a text can carry meaning in specific ways. Sometimes the information across different text elements is contradictory, sometimes the elements complement each other. At times verbal text (i.e. the written words) is the most important semiotic mode, sometimes the image. Each page thus offers different challenges for text interpretation, not least for students who are expected to make meaning of complex content from the text.

It is quite common that students in lower grades are encouraged to express themselves in both images and words. A number of studies, however, have revealed that it is unusual for teachers to comment on what is expressed in these images. This is true of narrative texts as well as more descriptive, factual texts. Usually the teachers regard them as some kind of ornament, focusing on aesthetic aspects of the image at a quite basic level, such as commenting on the image as, for instance, "nice", even when the images indeed carry specific and important meanings (e.g. Peled-Elhanan 2015). The use of such general comments might be explained by the fact that many teachers experience a lack of tools for giving constructive feedback in regard to other aspects of the images, and for multimodal aspects of texts. We hope that this book

will provide such tools. Since our discussions and analyses are based on the relations between text design (e.g. Kress 2010) and content, aesthetic aspects will be disregarded in the following.

1.2   A Historic Perspective on Multimodality

During different historical eras, people have used various resources in their communication. In ancient Greece and Rome, speech was the predominant resource for communication. Rhetoric, which was the analytical and educational instrument of that time, highlighted that the speaker needed to make the right choices when addressing the listener, and to shape their speeches to suit the specific purpose. Also, according to rhetoric, the speaker could utilize a number of other resources than speech, such as more or less formalized gestures to underline certain aspects of the speech, variations in tempo and intonation, or placement in the room.

When people started to use written language in different contexts, the function was to keep account of money, to make new laws, to describe historical events, or to celebrate a certain person, for example a Roman emperor who had won a battle, or a Nordic viking who had traveled far away and gained a fortune. During the Middle Ages, a system for large-scale copying was developed to copy handwritten biblical texts. Here, verbal text was combined with different forms of illustrations. In addition, the interior of the medieval church is an example of a multimodal text, where biblical stories were illustrated on the ceiling, on the pulpit, or as carved images on the baptismal font.

The development of the letter press led to the possibility of mass distribution of texts. When a market for books and papers arose, information could be stored and spread to a great many more people than had previously been possible. This situation also challenged different kinds of power relations in society. The printed word also repositioned the collective memory, and when public schools were introduced, the printed word had a special status concerning learning. To be knowledgeable was more or less equivalent to being able to memorize printed words.

Well into the twentieth century, school textbooks in Western society were based on writing, and they were quite often expressed in a narrative style. These written texts were sometimes illustrated with fact-based images or reproductions of paintings. From the middle of the last century, however, we have seen a change in the relation between writing and image, and image has become more salient and important in pedagogic texts (e.g. Bezemer and Kress 2008).

Thanks to the breakthrough of digital media at the start of the new millennium, various kinds of educational games and applications for digital learning have come into play in education, at the same time as mobile phones and tablets can be used in more advanced ways (Arnseth et al. 2018; Devlin 2011; Egenfeldt-Nielsen et al. 2011; Lindstrand et al. 2016; Selander 2008; Squire 2011; Steinkuehler et al. 2012).

To sum up, writing and image have been used in different ways through history, and different communicative resources have played different roles in different kinds

of texts. Today, a plethora of media are used in text production, and texts generally contain a variety of semiotic resources. Hence, it is important to pay attention to what kind of information is given through speech, writing, or image—or to put in another way: in what medium and through what semiotic resources is content expressed? Not least from an educational perspective, it is crucial to be able to discern how information is expressed and to realize how students are given opportunities to use different media and semiotic resources, in order to learn and to show their knowledge (Insulander et al. 2017). As a consequence, the forms for assessing and testing knowledge in educational contexts need to be developed in ways that allow for more resources than the written or spoken word.

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Chapter 2
Multimodal Texts and Literacy in a Digitized World

When working with multimodal texts in education the starting point must be the ways in which contemporary texts are constructed: they are multimodal and composed of various textual elements, something which can be challenging for the learner who is not yet familiar with a specific content area or text type. If teachers guide their students into an understanding of the ways in which texts are designed and how the information structure can be understood, they can harness their students' content learning. Other central aspects for teachers working with texts in education include developing a greater understanding of student-created multimodal texts, and developing assessment criteria that do justice to such texts.

The digitized media landscape affects society in several ways. In school contexts, there are numerous examples of how contemporary text and media worlds affect the ways in which educational settings are designed. One such example is the flipped classrooms where teachers provide their students with video-recorded outlines or lectures, or provide other learning resources digitally for the students to prepare before actually meeting in the classroom. During lessons in the physical classroom, time and effort can then be devoted to discussions, experiments or other types of activities. The access to digital resources affects the ways in which both teachers and students use their time, individually or in groups. However, regardless of the use of paper-based (textbooks and other types of texts) or digital media, students might need guidance in how to approach the texts.

2.1 Texts in and Outside of Schools

In contrast to the situation that prevailed when the authors of this book went to school, when there were still school subjects in which texts were not used at all, or to a very little extent, or where the subject content was mainly based on practical training, or trying out different techniques (such as physical education or art), theoretical discussions have become an integrated aspect of most subjects (to our knowledge, this is the

situation not only in the Scandinavian countries, where we have our main experience). However, "theory" does not necessarily have to be equivalent to "written texts", but even so, written texts have become increasingly important in many different subjects, as is evident in the curricula in many countries. This change is also evident outside of school contexts; in increasingly more workplaces employees are expected to use writing in quite complex ways, even in contexts that we might perceive as mainly manual (e.g. Karlsson 2009; Nikolaidou 2014). Our spare time, too, is filled with various text activities, from shopping lists and the planning of leisure activities to text messaging, Facebooking or Twittering (e.g. Barton and Hamilton 1998; Davies 2012). Thus, we live today in a text-based society with partly new types of text cultures.

To encounter a new disciplinary content in school always involves new ways of communicating. A lot has been written about the ways in which texts are structured linguistically in different content areas (e.g. Schleppegrell 2004; Martin and Rose 2008). Alongside this growing awareness, researchers have stressed the importance of working with language in conjunction with content in all school subjects. Such a way of dealing with disciplinary language (see Shanahan and Shanahan 2012, for a discussion on "subject literacy" vs. "disciplinary literacy") has been a central aspect in genre-based pedagogies, where one concern has been to find ways to support students in ways that promote their possibilities to become part of the discourse of different subject areas and the ways in which ideas are communicated within them (Christie and Derewianka 2008; Fang and Schleppegrell 2004). Regarding the use of other meaning-making resources than verbal language (written or spoken), however, there are obvious differences between disciplines too. Not only terminology or the ways in which the verbal text is structured differ between, for instance, a book spread in history and one in chemistry. Visual resources such as images, diagrams, and tables are just as important concerning textual choices. Therefore, learning a new subject and becoming part of the discourse in that subject involves dealing with many different meaning-making resources. Furthermore, it is essential to be conscious about when and how one meaning-making resource is the most efficient and appropriate to use (cf. *affordance*, below).

2.2 Text and Literacy—Changing Concepts

Parallel to the extension of the text concept, *literacy* has an extended definition today. Within the tradition of *New Literacy Studies* (NLS) (Barton 2007, Barton and Hamilton 1998) it has long been claimed that reading and writing are not delimited competencies for an individual to develop once and for all. Instead, from the perspective of NLS, encounters of new discursive areas entail new literacy practices. Therefore, during the course of our lives, we will be presented to new literacy challenges again and again. So far, New Literacy Studies have mainly focused on literacy practices in people's everyday lives (e.g. Barton and Hamilton 1998) or at workplaces (e.g. Karlsson 2009; Nikolaidou 2014). However, the question about literacy practices

in different contexts is as relevant for the school context, and not least in Scandinavian contexts, researchers have been inspired by this way of approaching texts and text use. The question of literacy practices within different fields of knowledge is also relevant from the multimodal perspective adopted in this book.

2.3 Towards a Digital Text World

The digitized world of today has brought new possibilities regarding text design and text production (e.g. Selander 2015; Sheridan and Rowsell 2010). To put it simply, anyone who uses digital media in their text production also becomes a text designer. A slightly more complex perspective on digitization is to view digitized texts as texts that involve new possibilities, such as integrating links to other texts or web pages, to use color for various purposes, to make animations, and to integrate sound or film clips in the text, and so on.

Digitization has also enabled new forms of mobile learning. One example is the use of mobile phones to perform mathematical calculations or to analyze water quality during excursions in nature, while simultaneously being able to communicate with students in other countries working with similar themes (Eliasson 2013; Nouri 2011). Thus, by using digital techniques, online communication is enabled, where other students can be invited to comment on the types of texts in use. Therefore, both texts and the context of creating texts are extended in quite radical ways.

Traditional paper-based texts—in which sentences are connected to paragraphs and paragraphs are connected to a whole—can be seen as more or less linear and with clear boundaries: we know where the text begins and where it ends. A digitally produced text can be linear in the same fashion, but the medium enables other possibilities that open up for a more flexible reading order. For the reader, therefore, the reading process differs from traditional texts. In a digital text, the question of beginning or ending is not self-evident. For example, should linked texts—possibly involving yet other links—be considered part of the text or not? A Facebook page is constantly under revision (at least with an active user), and the owner as well as other participants can add features such as text, images, or links.

Not the least among young people, applications such as *fan fiction* are popular, that is, websites where fans can write stories based on existing fictional worlds, such as popular novels, computer games, or television series, and where participants encourage each other and comment on each other's texts. In such communities, anyone who is able to create a text with a style similar to the original author can be expected to be particularly successful. In Chap. 5, "Cultivating Students' Text Creation", we will discuss digitally created texts in relation to text compilation and the use of references to sources (that is, "who owns the text?"). In school contexts, compilation texts are often regarded as problematic. In relation to, say, *fan fiction*, however, the question of ownership of texts is a difficult one, and maybe it is actually an irrelevant question altogether? This is how WideEyedDreamer01 at fanfiction.net

comments on his/her Harry Potter text: "Disclaimer: I don't own the Harry Potter series, it all belongs to JK Rowling. Enjoy and Review!" (fanfiction.net 2013).

When students work with digital media, one might expect a spontaneous use of multimodal possibilities, and the integration of various types of visual resources. Yet this is not always the case. A study from chemistry classrooms revealed that the digital possibilities were mainly used to create artistic headings (Danielsson 2011). In another project, students in a physics classroom complained when they were asked to use their tablets when drawing, commenting that it is easier to use pen and paper (Danielsson manuscript). In the chemistry classroom, students were relatively unaccustomed to using digital resources for laboratory reports. Furthermore, in many ways it is still easier to make drawings by hand.

Digital versions of textbooks are often examples of texts where the digital version is close to the printed one and where the dynamic possibilities are utilized only to a little extent. In previous textbook analyses, we have noted that textbook publishers quite frequently launch a digital version in parallel to a paper-based version of the same book (Danielsson and Selander 2014). Sometimes, but not always, the digital version includes the possibility for users to listen to the text by clicking on sections. Another option is to provide the user with the possibility to navigate between sections through links in indexes, or to include search functions, or the possibility to make digital notes in the text. In many of the texts we have analyzed, illustrations on the book spreads were identical between the paper-based and the digital version. Perhaps one might have expected greater differences between the versions given the potentials for digital media. However, it is likely that in the near future we will see rapid development in this area.

Today it is common for students to use the Internet to search for information, at least in schools where students are given access to computers or tablets. Of course, there are great differences as to the economic and practical conditions both between and within countries. For younger kids, there is a plethora of educational learning sites with links to other digital resources. In Part II of the book, we comment on one such site, produced by *National Geographic*.

An interesting Swedish study was performed by Ulrika Nemeth (2011), who investigated the use of web pages among upper secondary students during school lessons. In the classroom there were discussions about the reliability of sources, for instance in relation to the producer of the page. What was particularly interesting from a multimodal perspective, however, was that when students were searching the Internet for information related to assessments, the students themselves discussed reliability from other perspectives, such as layout. From these discussions it was obvious that the students considered pages with an inconspicuous design to be more reliable than colorful pages, or pages with many animations.

The use of film clips from YouTube, produced for formal learning, is another example of digital resources utilized for pedagogical reasons. What is striking in this regard is the variety of presentational styles in such clips. There are quite a few examples where, for instance, PowerPoint notes, or video-recorded blackboard notes, are commented on through a relatively traditional spoken lecture. These types of recorded presentations can be seen as parallel to digital versions of printed textbooks,

where it is mainly the media of presentation that has been altered, but not really the form of presentation. In, for example, the area of natural sciences, on the other hand, the technical possibilities of digital media have been used to produce relatively advanced animations (for instance regarding the relation between the sun and the earth), video-recorded experiments, or video clips like "Chemical Dance Party", with students acting as different chemical substances to illustrate the substances' tendencies to react with other substances.[1]

The changes of the conditions for texts and text-work in educational settings also include the use of games and simulations (Arnseth et al. 2019; Brooks et al. 2021; Gallagher 2015; Mørch and Thomassen 2016). One example is the Swedish game Minecraft, which we comment on in more detail in Chap. 13, "Educational Games and On-line Resources".

When using games for learning purposes, it is important to make the learning goals and learning objects explicit to the students. Also, the teacher can combine the use of games with other tasks, "outside" of the actual game to benefit from the joint engagement in the classroom.

In an international developmental project, researchers and teachers from Australia, Ireland, and Sweden collaborated in developing a game for collaborative problem solving and on the assessment and teaching of "21st Century Skills" (Nouri et al. 2017). In this game, students worked in pairs to solve a joint problem. The idea was that the two students had access to different information about the same problem and they needed to collaborate to get access to all information. Also, they needed to collaborate to find out what the problem actually was about and what information was relevant for solving the problem. To adapt the games to different educational contexts, researchers and teachers in the different countries adapted the games to be in line with the curricula and the specific learning goals in each country.

The teachers noticed some specific problems related to working with the cases and the assessment of the cases: one was that information about the group work had to be very precise in order for the students to be able to handle the cases; the other problem was that it was not evident which school subject "owned" a problem like "the pollution of the Baltic Sea", and was thus responsible for the assessment: was it Social Sciences, Chemistry, Physics, or History, or a combination of these subjects? In sum, the development of these games point towards interesting new possibilities: (i) to develop small-scale and locally adapted educational games, (ii) to include game-oriented elements in the learning activities, (iii) to use the opportunity to work collaboratively between subjects.

Hence, just as there is no typical paper-based text, there is no typical digital text. In educational contexts, the same challenges are connected to digital texts as for traditional, paper-based texts. Therefore, students might need different kinds of support when choosing and making meaning from digital texts. Thus, it is important for teachers always to consider the function of the various ways of (re-)presenting content, and how different choices, such as animations of ionic bond dancing at a "chemical party", might be challenging in students' meaning-making process.

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[1] A YouTube search for "Chemical Dance Party" results in a number of such films.

As mentioned, in educational contexts, the flipped classroom, or flip teaching, is growing. Using such ways of designing teaching is one way of employing digital media to be able to use time in the classroom in partly new ways. Often what students have traditionally been provided with in the classroom—such as a theoretical background to a content area—is now given through digital resources outside the classroom, and the students get access to these teaching resources through, for example, a blog. An example of flip teaching is when students are asked to view recorded lectures or PowerPoint presentations produced by the teacher, or freely accessible on the Internet. In that case, students can use the teaching resource in ways that fit their respective interests or learning conditions, and the classroom time can be used for activities like problem solving, group discussions, or hands-on activities, such as experimental work. When organizing learning activities in such ways, the time in the classroom can be used to focus on implementing the content that has been provided through digital resources, and for activities where the teacher interacts with the students in various ways.

The underlying idea behind the flipped classroom is for teachers and students to use classroom time for communicative activities or investigations of different types, and for the teacher to support the students in various ways. One benefit—apart from being able to utilize joint classroom time for communicative activities—is said to be that students often find classroom activities more meaningful. However, such a setup requires that students both have access to and are able to handle digital media, and also that they are able to take responsibility for their own learning outside the classroom.

2.4 Summary

In this section we have mentioned a number of changes regarding text practices in and outside of school. All of them affect curriculum documents and ways of formulating requirements regarding what counts as knowledge and how to assess it.

The digitized society has led to new possibilities and challenges regarding text design and text production. Everyone who uses digital media has also become a text designer. Furthermore, digital texts provide us with new affordances, such as the possibility to incorporate links and to add audio- and film-clips in texts. The Internet has also led to a new culture of sharing. One effect of such a sharing culture is that the limits of a certain text are no longer evident, and it is easier to integrate other texts in new texts, something which has consequences for education (Selander 2017). The digital development has also created new forms of teaching, such as the *flipped classroom.*

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Chapter 3
Semiotic Modes and Representations of Knowledge

When organizing our understanding of the world around us, we use *semiotic resources* (e.g. Kress 2010). Semiotic resources are resources that we use to organize our understanding of the world and to make meaning in communication with others, or to make meaning for ourselves.[1] When these semiotic resources are used in systematic ways they form *semiotic modes*. Examples of semiotic modes are color (when color is used in more or less conventionalized ways), spoken or written verbal language, images, or gestures. A semiotic mode in itself can actually be viewed as multimodal, for example an image where color is used as one meaning-making resource. Semiotic modes can also be combined differently in different media—such as paper-based or digital media. In all social communication we combine semiotic modes. Thus, social communication is always multimodal (e.g. Jewitt et al. 2016).

3.1 Knowledge Representations

One might assume that we can choose any available semiotic mode for making meaning, and that it is possible to express "the same" content through any semiotic mode. From such a perspective, the choice of semiotic mode would rather be based on aesthetical or practical choice. A more philosophical question is whether it is actually possible to separate content from form. If we imply that all knowledge must formulated somehow, and that all knowledge is represented through some kind of system for meaning-making, form is crucial for deciding what aspects of the content are given precedence. For an expert of a field, the ways in which content is presented are of minor importance. For the novice entering new knowledge areas, however, the

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[1]The difference between semiotics and social semiotics is that semiotics emphasizes the relation between sign and meaning, while in social semiotics social conventions and situational factors are given greater prominence (Kress 2010).

ways in which content is presented can be crucial for the learning process (also see Jewitt 2008; Selander and Kress 2010; Danielsson 2016).

3.2 What Semiotic Modes "Count" in Schools?

The fact that we can use many ways of communicating content, and that all written texts to some extent are multimodal, can be contrasted to the text traditions in schools, where the written word is given most prominence, as the resource that is still valued and "counts".

By focusing only on the words in student texts, there is a risk of missing important aspects of what is actually said. In a project on the text worlds of pupils in primary school, Charlotte Engblom (2010) made an interesting point regarding what counts for teachers and pupils, and that their interests can sometimes be contradictory. In one classroom activity, when students were asked to produce a text on the computer, one pupil made a conscious spelling "mistake" on the word *mum*, to allow the words in the sentence to be placed in a way that made the image appear at the right place on the page. In this case, the visual appearance of the different text resources (image and words) was considered more important than correct spelling. The problem for this student was not spelling, but instead how to handle the digital tool, in this case to make the words appear at the right place without manipulating the word length.

With regard to different views on texts and what counts, traditions vary in different school subjects. In more practically oriented areas, such as crafts or arts subjects, the tradition of viewing the written word as the most important resource is less prominent. At the same time, in such areas there is a risk that the plethora of multimodal texts that are actually utilized might be overlooked, for instance sewing instructions or drawn plans. However, even subjects that we regard as highly theoretical, such as the natural sciences, have long traditions of using an abundance of visual resources and representations, such as images, diagrams, or three-dimensional models.

3.3 Semiotic Mode and Meaning Potential

One aspect related to semiotic mode is their aptness in relation to different types of content. Spoken or written words are specifically suitable for expressing temporal aspects (*first* this happened, and *then* this) or issues of cause and effect (x happened *because of* y), while images are better apt for spatial relations (e.g. Kress 2003). This does not mean that we *cannot* use images to express temporal relations; if we want to do that we can use more or less culturally established resources such as arrows, reading order between a series of images, etc.

The choice of resources for meaning-making is linked to the notion of modal *affordance* (e.g. Gibson 1977; Kress 2003), in other words the "meaning-making

potential" or the "potentials and limitations" of certain semiotic resources or modes in a specific situation.

The term *affordance* can be illustrated by the variety of semiotic resources that students come across when a natural phenomenon like the atom is explained in chemistry classrooms (Danielsson 2016). For example, in textbooks, combinations of writing, including chemical or physical symbols, and images are used, and in their expositions, teachers use words (spoken or written), written symbols, images (drawn on the board or projected on a screen), and gestures. In words, metaphors like "electronic cloud" or "electron shells" are used, or the atom is described through analogies, for instance by comparing electronic orbits with the planets' (electrons) movements around the sun (atomic nucleus).

The choice of semiotic resource for meaning-making is never made at random. Instead, more or less conscious choices are made, based on available modes or specific resources in the meaning-making situation. The choice is also dependent on what we want to say, and to whom, depending on the affordance of different resources. Also, the choice is reflected by what aspects of a phenomenon a certain representation can be used for (e.g. Danielsson 2016, Tytler et al. 2013). For the novice, the intimate connection between content and resources chosen for representation has consequences for learning: to learn *what* signifies an atom cannot be separated from learning *how* the atom can be represented. This connection is commented on by Diana Laurillard thus: "Knowledge technologies shape *what* is learned by changing *how* it is learned" (Laurillard 2012, p. 3). She illustrates this statement by an example from a course in Business Studies: when the students are expected to read and write, their analytical competencies are supported, when role play is used, their experiences and their understanding concerning interpersonal relations, and when they are using Excel sheets, experiments and calculations of different economic parameters are supported. The given—and conventional—representations have consequences for what is recognized and assessed as relevant knowledge in the subject.[2]

Thus, different resources have different potentials for meaning-making. The different particles of an atom can be illustrated through a drawn image, and at the same time you get an approximate idea of how the different particles are related: that protons and neutrons form the nucleus, and that electrons revolve around the nucleus. Yet, when we draw an image, we have to decide where to place the different parts in relation to each other, and we have to decide their relative sizes.

A drawing of the atom will always be a simplification, and in fact a falsification, for example since the electrons are so extremely small in relation to the protons and neutrons in the nucleus, something that cannot be illustrated on a limited surface such as a textbook page or a board in the classroom. Furthermore, the electrons have to be placed somewhere. They are often drawn in distinctly delimited orbits, although there are in fact no such distinct orbits. Instead, the electronic shells one talks about in science are more of an illustration used to indicate the plausibility of the position of an electron at a given moment.

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[2]Kress and Selander (2012) discuss this in terms of what is recognized as "signs of learning" within "cultures of recognition and assessment".
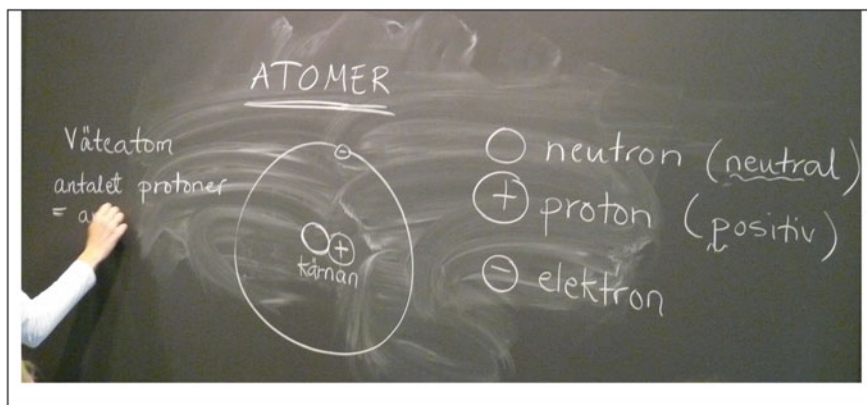
Fig. 3.1 Teacher's illustration of the atomic model in a secondary school chemistry classroom (from Danielsson 2016, with permission from the author)

You need only a quick look at the illustration in Fig. 3.1 to get a general image of the different particles of the atom, and their approximate relations to each other. On the other hand, through words, it is possible to clarify that the electrons are not placed in clearly defined orbits, and that the exact placement is always arbitrary. Through words and mathematical symbols you could also describe, for example, the relative sizes of protons and electrons. With multimodal ensembles, such as combinations of words, images, and other resources, a relevant (though still simplified) image of the atom as a natural phenomenon can be given.

Already when students start school, they have some level of knowledge—most probably implicit—of what is best said through what semiotic mode. Figure 3.2 is an example of how a Norwegian pupil in first grade uses a combination of writing and image when creating a text after an excursion to the sea (Sjøhelle 2013). In that text, the student has drawn a crab that he found during the excursion. For this student it is obviously an important piece of information that crabs move sideways. However, to depict such a movement in an image is difficult, and he comments on that in writing: "crabs move sideways" (No. *kraber går sidlengs*). School can benefit from the fact that even young students use different modes in accordance with their affordance when creating their own texts and when working with pedagogic texts in the classroom teachers can connect to this implicit knowledge.

Resources used in meaning-making have a culturally established meaning potential which embraces both the offered meaning (for example the intention of the illustrator or the author) and the perceived meaning (what the reader of the text pays attention to). Not the least from an educational perspective, it is important to note that in the actual meaning-making situation it is not always the case that the intended meaning coincides with the perceived meaning. Instead, the reader's interest, as well as the reader's previous knowledge in the area, can direct what meaning is actually made from the text.

Fig. 3.2 Student text (year 1) after an excursion to the sea (Sjøhelle 2013, p. 114, re-printed with permission from the author)

3.4   Implications for Education

From an educational perspective, it is a great asset to have an abundance of semiotic resources to choose from when engaging in various aspects of content. Yet we cannot take it for granted that the students will be able to handle the different resources without guidance, or to be able to see their possibilities and limitations. If we stick to the example of the atomic model, we can imagine that for anyone who already knows the structure of the atom, and the characteristics of this natural phenomenon, it can be functional to compare the atom with an apple (an analogy sometimes used in

Swedish speaking classrooms[3]) without pondering about what the fruit pulp could be analogous to. Furthermore, the expert knows that there are no prefabricated "shells" for electrons to place themselves upon. However, such analogies can give false ideas to anyone who is not familiar with the content, such as a student who in an interview expressed the idea that "the shell becomes empty" when ions are formed, with valence electrons "leaving" an outer electron shell.

3.5 Summary

In this chapter, we have discussed *semiotic resources* in terms of the resources we use to communicate and to organize our understanding of the world around us. When semiotic resources are used in systematic ways, these can be seen as *semiotic modes.* Examples of semiotic modes are verbal language (written or spoken), gestures, and color (when the color in itself carries meaning, such as red for heat or to depict "stop!").

What semiotic resource to use—and in which semiotic mode—is connected to the content that is communicated: you cannot say exactly the same thing through any semiotic resource. Semiotic resources or modes are said to have different *affordances*, or potentials for meaning-making.

The ways in which a text is designed through different semiotic resources are particularly important for the "novice" who is about to enter a new domain of knowledge. From an educational perspective, we cannot take it for granted that our students are able to handle the different multimodal resources without guidance, or to fully understand their meaning-making potential (or affordances and limitations). By working actively with the students and making visible to them how texts are structured, we can support them in reading the texts as genres of texts in specific content areas, and consequently make it possible for them to deepen their knowledge in the particular subject content.

The extended text concept as well as the understanding of multimodal texts challenge the dominant school tradition, where writing has been seen as the main resource and the resource that is valued and "counts" as representation of knowledge. It also challenges our more traditional ways of assessing knowledge primarily by the use of "written, verbal language".

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[3] In Swedish, the word for nucleus (*kärna*) is the same as for seed (*kärna*), and shell for atomic shell is the same word as peel (*skal*). Therefore, this analogy is possible in a Swedish-speaking context (see Danielsson et al. 2018).

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Chapter 4
Working with Multimodal Texts in Education

4.1 Who Can Read and Write?

The insight that different texts and genres make different demands in the meaning-making situation must lead to an extended view of reading and writing as meaning-making activities, and of literacy development for the individual. From that perspective, the development of literacy does not consist of "learning to read and write". Instead, an important aspect is to develop *textual repertoires* to be able to make meaning through different texts, including repertoires concerning writing as well as other semiotic modes—in different genres and in different subject-specific contexts. Furthermore, the development of textual repertoires concerns a variety of texts, from writing in paper-based media to highly multimodal, hyperlinked texts in digital media.

Today, all teachers must handle multimodal texts, and they need to have an awareness about the ways in which different resources for meaning-making work. However, they also need to develop teaching practices that involve strategies that enable ways of handling texts that are perceived as challenging. From this point of view, meaning-making through texts must develop continuously. There is no exact moment when we can say that a certain student "has learned to read" in an absolute sense, something which makes partly new demands of teachers in all disciplines.

4.2 The Expert and the Novice

As mentioned, each semiotic mode has a more or less culturally established potential for meaning-making. However, readers note and interpret different aspects of a text depending on their previous knowledge, specific interests, understandings of the situation, genre knowledge, etc. This situation applies both to anyone knowledgeable in the field and to those for whom the field is new. It is especially important here to be aware of the fact that someone with a great knowledge of the field might not realize

the potential challenges in texts or other learning resources. The expert in the field will, without being conscious about it, fill in potential gaps, and weed out extraneous information. Moreover, it is doubtful (or rather, it is implausible) that the offered meaning from the perspective of the expert will be the same thing as the perceived meaning from the perspective of the novice.

4.3   Curriculum Documents

Every country compiles a curriculum in line with its own traditions, but also inspired by the development in other countries. Thus, we can find examples of curricula with a clear emphasis on multimodal texts, even though most countries do not yet explicitly require multimodal competence as a specific competence in their curricula.

At the same time global research, as well as new educational practices concerning how to represent knowledge and work with learning in schools, obviously change the learning landscape. Therefore, a multimodal (and multimedial) understanding seems to be of increasing importance.

4.4   Text Talk in Education

It is common for teachers to work with students' prior knowledge of the subject matter when introducing new content in class. Working with prior knowledge can involve giving an overall introduction to the content area and working with central concepts, or connecting to the students' previous knowledge of the area in various ways. To work with students' previous understanding in such ways can function as a support for many students, not least to facilitate their understanding of a complex content. Yet, if the teacher does not also support the students in how to grapple with the actual texts that they are supposed to make meaning from, they might never need to get to grips with texts. This in turn can have negative consequences for the students as they might lack essential tools later on, when they will have to deal with different kinds of texts independently.

Numerous classroom studies over the years, from different subject areas and school years have revealed that teachers seldom engage students in discussions focusing on how texts within the area are structured and why (Danielsson 2010; Digisi and Willett 1995; Edling 2006; Wellington and Osborne 2001). It appears as if it is often taken for granted that anyone who has broken the written code and reached some level of reading fluency should not need any guidance as to how to make meaning from or produce different kinds of texts. An exception is of course writing education within the mother tongue subject. Also, there are examples of schools focusing on language and content, where teachers in the mother tongue collaborate closely with teachers in other subjects, for example in schools working with the genre pedagogy. More often, however, if any collaboration takes place between subjects, it

often concerns a general level, with no focus on the chracteristics of texts in different subjects.

Furthermore, research has shown that even within subjects where an abundance of resources are central for meaning-making, such as images, abstract models, mathematical symbols, etc., teachers tend not to highlight the specific demands inherent in such texts (Danielsson 2010; Løvland 2010; Öman and Sofkova Hashemi 2015). Both teachers and students seem to assume that images always support the content, and that images in themselves cannot be a challenge in the meaning-making process. Furthermore, teachers appear not to draw any specific attention to the multimodal aspects of student texts, for example when students create PowerPoint presentations.

There may be various ways of explaining why so many studies reveal the same pattern. It could be that we tend to take certain things for granted, as we commented on in relation to the semiotic modes that are valued and "count" in school. It could also be the case that teachers lack tools for talking about and assessing multimodal aspects of texts (Bearne 2009). Teachers might want to highlight multimodal aspects of texts, but they do not really know how to do it. We hope that our discussions about multimodality and the model for working with multimodal texts in education can function as a support for teachers wanting to develop their teaching in such a direction.

Before presenting our model for working with *multimodal* texts, we will comment briefly on some other models that have been developed for working with texts in education, although primarily with *writing* (i.e. written words).

A number of these models are based on methods for working with reading comprehension, such as *Questioning the Author*, which is a scheme developed by Isabel Beck and Margaret McKeown for the reading of literature (e.g. Beck and McKeown 2006), which has also been adopted for working with factual texts.

The basis of genre pedagogies (e.g. Christie and Derewianka 2008) is that an explicit focus on text structure in class will harness students in their text encounters. Within genre pedagogy, both the form and the function of texts in different subject areas are emphasized. Thus, the focus is both on text structure and on the fact that there are functional reasons for differences in structure. In genre pedagogies, it is common to work with reading and writing in parallel, for example through the "circle model" (e.g. Rose 2005), which is based on mutual deconstruction and construction of texts, and that the teacher and students pay attention to various features of the text. During such discussions it is natural to discuss what consequences it would have if alternative ways of expressing the content were chosen.

As said, these models are mainly based on written verbal language, which is all well and good. Yet if we bear in mind that texts usually consist of a variety of resources and not only writing, it is just as important to highlight the interplay between different semiotic resources and how to tackle texts from a multimodal perspective (e.g. Tan et al. 2012), not least concerning pedagogic texts.

Also, working with multimodality has potentials to improve students' text envisionment (Langer 2011), or *text movability* (Liberg et al. 2002), that is, to be able to approach and relate to texts and their various functions in different ways. So far, students' text movability has mainly been studied in relation to the verbal aspects of

written text. However, a Danish small-scale study by Jesper Bremholm (Liberg et al. 2012) describes how secondary school students show more limited text movability in regard to multimodal aspects of texts in science compared to the verbal aspects of the same text.

4.5 Model for Working with Multimodal Texts in Education

Note: The presentation of the model is based on an article published in the Open Access Journal *Designs for Learning* (Danielsson and Selander 2016[1]). That article gives the foundations of the model and this is done through the same text examples as used in the following. However, due to reasons outside of our control, we have not been able to obtain a permission to use examples from one book in the following, and therefore, we refer to the original article regarding the Chilean examples in the following.

As said previously, from an educational perspective, we believe that "the expert" (often the teacher) might need tools to identify potential challenges in multimodal texts. The model presented in the following can be such a tool. Furthermore, we believe that teachers can use the same model as a basis for classroom discussions about multimodal texts with students, who are likely to be "novices" as regards the content in focus.

Table 4.1 presents our model for working with multimodal texts in education. In the development of the model we have drawn on social semiotic and multimodal perspectives of meaning-making (Bezemer and Kress 2008; Jewitt et al. 2016; Kress and van Leeuwen 2006), and specifically so in subject-oriented knowledge domains. The model is empirically grounded on research revealing that meta-textual classroom discussions generally are scarce in classroom practices, and in particular in relation to multimodal aspects of texts.

Briefly, the model comprises the following aspects of texts:

- The general structure of the text;
- the interplay between the various resources used in the text;
- figurative language;
- values (explicit and implicit).

Thus, besides focusing on aspects such as the general structure of texts and the interplay between different resources, which are central from a multimodal perspective, the model includes the use of figurative language (metaphors, analogies, similes, see for instance Cameron 2002) as well as values. In the following we give some comments on that.

Research and theory concerning metaphors and analogies is vast (one key volume is Lakoff and Johnson 1980). There are several ways of defining these terms and it is not always easy to draw a sharp line between them. For the purposes of this

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[1]https://www.designsforlearning.nu/articles/10.16993/dfl.72/.

Table 4.1 Model for working with multimodal texts in education (based on Danielsson and Selander 2016)

	Multimodal text focus	Classroom focus
General structure	Thematic orientation and sequencing (What is the text about and how is the content arranged?)	Focus of the overall structure of the text and of the different parts of the text and what content they provide
	What does each one of the text resources express? (images, diagrams, headings, introductory paragraphs, etc.)	
Interaction between text resources in the text	Proximity and coherence between different text resources	Reflection on the interaction between different text resources and what aspects of the content appear central
	Congruence and coherence between concepts, descriptions and explanations given through different text resources	
Figurative language	Metaphors (incl. analogies and similes) in different text resources	Deconstruction of the figurative language given through different text resources. What is the reach of the metaphors and analogies? How well do they function for the specific content?
Values	Explicit	Discussion of aspects such as right/wrong, us/the others, female/male, etc
	Implicit (e.g. in metaphors, images, perspectives)	

book, however, we draw on the central idea that all definitions include a possibility of activating two distinct domains, and in line with, for instance, Cameron (2002), our use of *metaphor* includes both of these types as well as explicitly expressed similes (e.g. "my love *is like* a red red rose"). Since we here focus on multimodal texts, we also include other means of representing metaphors apart from linguistic expressions.

Figurative language is a natural part of the disciplinary discourse in many areas (e.g. 'monetary flow' or 'magnetic fields') and is frequently used as a way of understanding and talking about complex structures or processes. Also, such expressions function as pedagogical tools, for example to make "visible" what is not possible to see directly (like micro-worlds, or rather abstract phenomena as a 'monetary system', or concepts like 'democracy'). To some extent, figurative language can function in the same way as a visual model. By using it, it is possible to make an inner visualization that summarizes the main points. At the same time, a metaphor can also be a simplification and generalization and it is not always clear how far an analogy or metaphor reaches. For example, it might not be obvious what parts or aspects of the source domain (e.g. electron *shells* in the example mentioned in Chap. 3) and the target domain (e.g. the atomic structure) are actually similar, and what parts

or aspects are not. Especially for the "novice" in the field the reach of metaphors might not be obvious. Therefore, even though metaphors can support students in their meaning-making, such use has also been noted to be potentially challenging, for instance if students take an analogy or metaphor too far or interpret them literally (e.g. Haglund 2013; Danielsson et al. 2018). In the case of the atom, the metaphorical use of "electronic shells" to explain the ways in which electrons move around the nucleus at a certain distance, gives an impression that there are actually shells where electrons can be placed.

Values, both explicit ("you should eat healthy food") and implicit ("Huowei skipped breakfast; therefore he is tired"), can also be expressed through different semiotic resources. Since images can be used to convey values in implicit ways, multimodal perspectives have previously proven fruitful for such analyses (e.g. Kress and van Leeuwen 2006), something which has also been emphasized in relation to pedagogic texts (e.g. Unsworth 2007).

Included in our model are also comments on how teachers and students can work stepwise, unfolding and discussing the text, thus supporting meaning-making around the content. In such discussions, an overall perspective can be that there is always an author behind a text, and that this author has made a number of choices in regard to choice of content, as well as what resources to use and how. This way of discussing texts, highlighting that there is always an author behind it, is central for the framework *Questioning the Author* mentioned above. That framework, however, is based on verbal text only. To discuss texts in explicit ways is important, not least because the novice in a field of knowledge cannot be expected to be able to fill in the missing parts, or make explicit the implicit links or relations between different pieces of information. By highlighting that there is always an author that has made *choices*, can be a way of connecting to the students' own text production in different school subjects. Furthermore, by highlighting authors' choices, students who might find texts challenging can feel confident in actually questioning the author's choices rather than questioning their own capability to make meaning from the text. Such discussions can also function as a way of supporting the students' development of *critical literacy* (e.g. Luke 2000). Altogether, the different aspects of the model underpin the development of meta-cognitive skills through an understanding of how different resources operate to represent knowledge.

As mentioned, a number of frameworks for working with texts have been developed previously, though generally with a bias towards writing, thus disregarding other resources, such as tables, graphs, and diagrams. Examples of exceptions are a model presented by Unsworth (2001) and the framework *Multimodal Analysis Image* (Tan et al. 2012). In comparison to those models, our model has a stronger focus on subject content and meta-textual classroom discussions. Thus, it has a double benefit in that the model supports students' meaning-making related to subject content while at the same time having the potential to support students' development of multimodal literacy.[2]

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[2]*Multimodal Analysis Image* (Tan et al. 2012) has been used in exploratory studies in Singaporean schools (Lim et al. 2015). However, rather than focusing on content and multimodality, the main
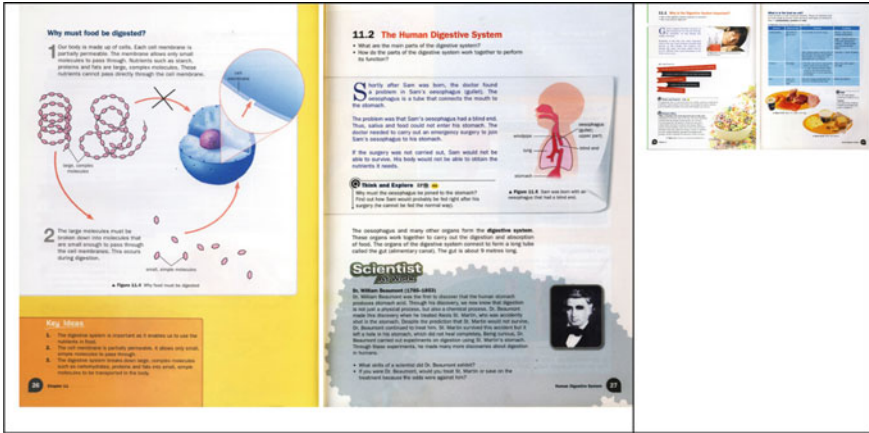
Fig. 4.1 Food digestion, lower secondary school, *Science Matters, Lower Secondary* (Fong et al. 2013, pp. 24–27, with permission from Marshall Cavendish Education)

Our presentation of the model is based on sections on human digestion in two textbooks in science, to illustrate the different parts of the model. One book is Singaporean, used for lower secondary school (students aged around 14); the other one is Chilean, used for middle-grade students (students aged around 11). Figures 4.1, 4.2, 4.3 and 4.4 are images taken from different parts of these sections in the Singaporean textbook. As mentioned, the images from the Chilean textbook can be found in the original article presenting the framework (Danielsson and Selander 2016).[3] For the complete chapters of each of the books, we refer to the original text books. Our point here is not to make any kind of comparative cultural analysis. Instead, we want to demonstrate that the framework is versatile and applicable across different cultural contexts, with a focus on how the orchestration of text resources through different semiotic modes has consequences for how to grapple with the text as such and for the interpretation of the content. Here we concentrate on paper-based pedagogic texts. With minor adaptations, the model can also be used for digital texts involving resources such as moving visuals, sound, and hypertexts. We use here examples from one subject to illustrate the various parts of the model. In the second part of this book we use it to analyze texts from a great variety of subjects. There it will be clear that in different texts as well as in different subjects, certain parts of the model might be more important than others.

Our point of departure is how different text resources are used to build up the text as a whole, how different text resources interplay and the potential challenges regarding the different resources as well as their interplay. Also, we comment on the implications for education, suggesting ways of discussing the texts. Such text

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intent in these studies has been to cultivate students' multimodal and critical literacy, for example by letting students analyze and create multimodal texts in relation to advertisements.

[3] The original article including all images, can be found here:
    https://www.designsforlearning.nu/articles/10.16993/dfl.72/
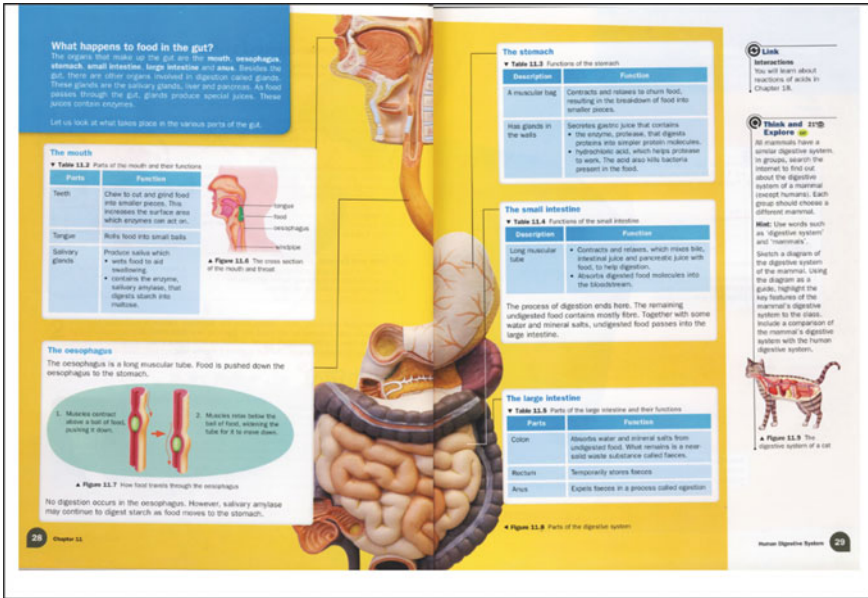
Fig. 4.2 Food digestion, lower secondary school, *Science Matters, Lower Secondary* (Fong et al. 2013, pp. 28–29, with permission from Marshall Cavendish Education)
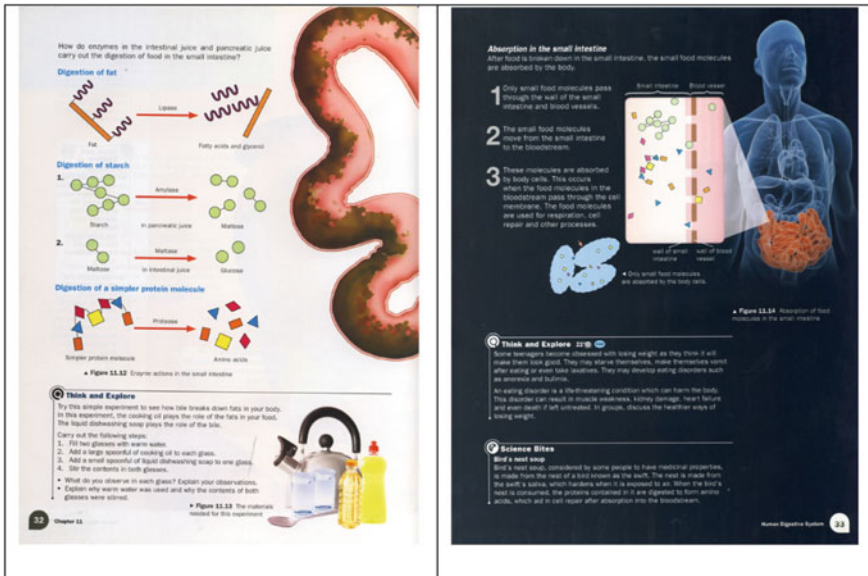
Fig. 4.3 Food digestion, lower secondary school, *Science Matters, Lower Secondary* (Fong et al. 2013, pp. 32–33, with permission from Marshall Cavendish Education)
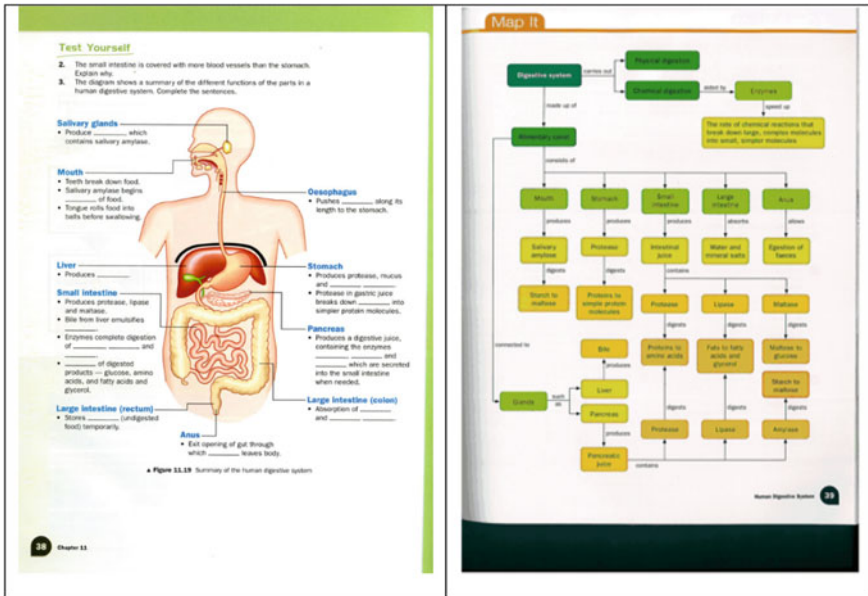
Fig. 4.4 Food digestion, lower secondary school, *Science Matters, Lower Secondary* (Fong et al. 2013, pp. 38–39, with permission from Marshall Cavendish Education)

discussions must of course be adapted to the students' age, interests, and previous experience of reading and discussing various kinds of texts.

The model is relatively extensive, but there is no need to always use all parts of the model for all texts. Instead, depending on the content area and the purpose for which a specific text is used in the educational situation, different aspects of the model can be concentrated on. In the second part of the book, we have made a number of close readings of texts in different content areas. In relation to those readings, we also give some examples of what could be fruitful to focus on in text discussions in the classroom.

4.5.1 General Structure—Setting

The analysis of the general structure can be connected to the notion of *setting* in the designs for learning framework (Selander et al. 2021). In our model, the analysis of the general structure is meant to capture the ways in which a text "invites" its reader and calls for certain types of activities by its means of representing the content. Here we start off by looking at the *thematic orientation*, and then the *sequencing* of the text. After that, we go on to examine what the different text resources express in regard to content, such as different kinds of illustrations, headings, and text boxes. The aim of examining texts in regard to the general structure is to get an overview

of the text as regards both layout and content. For meta-textual discussions in the classroom, this is a suitable starting point, and even quite young students can be involved in such discussions. Things to highlight in the discussions could be what content seems to be expected to be found in the text (from the information that, for instance, headings and illustrations offer to the reader), what resources "stand out", what roles different types of illustrations seem to play, and if there seems to be an expected way to go about reading the text.

In regard to the *thematic orientation* of the Singaporean text, the miniature in Fig. 4.1 shows the starting point of the chapter "Human digestive system". The left page is the first one of the introductory section headed "Why is the digestive system important?". This heading provides the students with the main concept, "the digestive system", and by expressing the heading as a question, the intention seems to be to draw the students into the content by making them curious to find out the answer.

The chapter as a whole has a structure that evolves from a direct connection to students' everyday lives to a purely scientific approach to the content. It starts off with a short text about a boy who has skipped breakfast and therefore is feeling hungry and weak. Then a table presents nutrients with comments on their molecular sizes, function, and examples of food in which they can be found (see miniature in Fig. 4.1). Through this table the reader is taken one step further into the scientific aspects of the content. The remaining part of the chapter on the human digestive system mainly deals with the digestive system from a scientific point of view, including chemical aspects of digestion (e.g. large image in Figs. 4.1, 4.2, and 4.3).

Even though the chapter takes on a gradually more scientific approach, different activities, sometimes labeled 21st Century Skills (Figs. 4.1, 4.2 and 4.3) connect the topic to the students' everyday lives throughout the chapter. Towards the end of the chapter, the human digestive system is summarized in a flow chart (Fig. 4.4). It is worth noting that it is not until the flow chart at the end of the chapter that the terms *physical* and *chemical digestion* are defined, even though the terms are used throughout the chapter.

The section on digestion in the Chilean textbook begins with a book spread with a series of pictures resembling a comic strip with some writing below (for images, see Danielsson and Selander 2016). The following bookspread consists of a running text in the upper part of the bookspread, with a series of images below that. In regard to the *thematic orientation* of the Chilean text, it also starts out with a a heading formulated as a question("¿Cómo funciona nuestro cuerpo?", *Eng.* "How does our body function?"), inviting the reader to learn more. Here, the starting point is the series of pictures over the double-page spread in which two children decide to make an imaginative journey through "the body". The journey goes from the stomach to the heart via the blood and after a detour to the lungs back to the blood circulation, it finally ends with the children floating in urine in a bladder. During the journey, the two children note things such as nutrients and oxygen entering into the cells of the organs.

Underneath this, under the heading 'I observe and respond' (Spa. "Observo y respondo"), students are given questions that are supposed to make them read the comic strip more closely, for example by questions about the different body organs

that the children encounter. On the left page of the double-page spread, a number of questions invite the reader to describe, for instance, the essential functions of different body systems. However, there is no explicit information in the comic strip that gives specific information about these systems.

The following pages in the Chilean book go deeper into the subject-specific content. Here a series of pictures at the lower part of the bookspread gives gradually more abstract and detailed representations of parts of the intestines, starting with a photo of a child eating an apple, ending with an image of a cell which is said to be one of the many cells building up the intestines.

In the comic strip as well as in the writing accompanying the illustrations in the following book spread, scientific terminology connected to the topic is used frequently. The following section deals with the physical and chemical aspects of the digestive system. Here labels give the scientific concepts connected to the human digestive system presented in an image, similar to the Singaporean book spread in Fig. 4.4. An explanatory text describes the kind of processes that go on in the various parts of the system shown in that image.

As we note from the analysis of the thematic structure in the books, there are similarities between the texts. Both of them invite the reader to the content by using questions as headings, and they both use a connection to the students' everyday lives as a starting point.

Sequencing deals with text structure at a general level, for example to what extent the information structure invites the reader to read the different parts of the text in a certain order. From a brief look at the book spreads in Figs. 4.1, 4.2, 4.3 and 4.4, and the two bookspreads from the Chilean book (see Danielsson and Selander 2016), it can be noted that it is only the second bookspread in the Chilean book that has a traditional structure, with a body text clearly separated from the illustrations. In the other texts, different textual and visual modes are intertwined. Another way of sequencing is found in the book spread from the Singaporean textbook in Fig. 4.1, where the left page is dominated by the image depicting a cell. Such a prominent image, in both relative size and central placement, draws the attention to that area of the page (see Kress and van Leeuwen 2006, for a discussion of salience). At the same time, the numbers 1 and 2 imply a reading order starting at 1. This type of visualization, with the prominent image of the cell, including a zoom-in on a cell membrane alongside numbered text sections and arrows, is common in pedagogic texts. Such visualizations imply a reading order following the arrows, where the reader is supposed to juggle between writing and visualizations, using the arrows to follow a process. In this case, however, the numbered arrows have partly different functions, with two arrows (one crossed over, being a "dead end") pointing in divergent directions from the verbal text numbered "1". The arrow that is crossed over functions as a notice that big molecules cannot pass into the cells, and therefore (which is not stated explicitly) we need the digestive system to make big molecules smaller. Thus, drawing attention to the general overview and the ways in which the reader is "invited" into the text can function as a form of guidance for the students, at the same time as possible challenges (such as the use of arrows for different purposes in the visualization) can be highlighted in such discussions.

With regard to what the different semiotic resources are used for, we concentrate mainly on the book spread shown in the large image in Fig. 4.1. This spread contains images of various kinds (abstract images, like the human cell and the molecules, as well as more realistic images, such as the black and white photo of a scientist), writing in different forms, for instance body text, headings of various levels, and words integrated in visualizations.

The image on the left page is used for showing aspects such as wholes and parts of the cell and for giving a more concrete image of abstract content, such as simple and complex molecules. At the same time it gives a kind of time sequencing (large molecules breaking down to smaller molecules) and processes (simple molecule passing through the cell membrane). This explanatory use of the image can be compared to the more illustrative images on the previous spread in the textbook (miniature in Fig. 4.1), with the tired boy resting his head on a desk, and food on plates, or the schematic image on the left page of the following book spread, shown in Fig. 4.2, labeling different parts of the upper digestive system.

Also, various kinds of graphic devices are used in the book spread shown in Fig. 4.1, for example text boxes and bolded words in the body text. The use of text boxes of various kinds is common in textbooks. In the Singaporean book, text boxes are used to mark key ideas, using an explicit heading. Throughout the book, recurrent activities intended for the students to go beyond the immediate "facts" in the book to connect them to real-life situations are marked "Think and Explore", with an explicit connection to "21st Century Skills". The Chilean textbook also provides the reader with a number of key concepts in a text box shown in the second book spread (see Danielsson and Selander 2016): in this case different types of body tissues (Spa. *tejidos*), which are given in bold text. However, this information is given under the heading 'Did you know?' (Spa. *¿Sabias Que?*). Such headings are quite frequently used for texts intended to raise the curiosity of the reader, but perhaps giving less important information.

Since there are no "rules" as to how to use different graphic devices in a text, there are good reasons to discuss and make explicit how different resources are used in a specific text when introducing it in an educational context.

4.5.2   Interaction Between Text Resources in the Text

An important aspect of multimodal texts in education is the relationship between the different text resources on the page (or equivalent), and the different ways these resources are used for expressing various aspects of the content. When examining the interaction between text resources, we examine to what extent the different resources give the same, overlapping, or different/supplementing information (also see Unsworth 2007). When different resources supplement each other, they can sometimes appear to give partly contradictory information, at least for the novice in the field. One such example is when a concept like the atom is presented as a static phenomenon consisting of various particles in an image, while at the same time

other resources like verbal text or gestures (in the classroom practice, or in a video) focus on the dynamic aspects of the atom, with electrons swirling around a nucleus (e.g. Danielsson 2016).

Both students and teachers tend to view images of various kinds as a way of facilitating the reading of a complex text (Danielsson 2011). Images can of course be used to visualize or simplify a complex phenomenon or reasoning. However, they might also add new, complex—or contradictory—information. Therefore, images too can be challenging for the interpretation of the text.

When creating multimodal texts, one always need to decide whether some content should be given in images (and why). Besides that, a number of other choices have to be made as to *how* to depict the content in image (photo, drawing, graph, etc.) and what level of abstraction that would be suitable for the content in relation to, for example, the intended reader. Here we can make interesting comparisons between the series of pictures in Fig. 4.3 from the Singaporean textbook, and the images shown in the second bookspread in the Chilean book (see Danielsson and Selander 2016), which to some extent are used for parallel content, such as the fact that the intestines play an important role for the digestion. The Chilean textbook is intended for slightly younger students. In this case, the series of pictures starts with an everyday, concrete photograph (a boy eating an apple) and moves towards more abstract representations (a drawn image of the cell). The Singaporean textbook, on the other hand, shows a less concrete image of a body (presented in a kind of X-ray fashion), and this image is supplemented with a zoom-in which gives a schematic image of the walls in the small intestine and a blood vessel, where "small molecules can pass". This zoom-in, in turn, is supplemented with a schematic image of the cells. The series of pictures with gradually more abstract content in the Chilean textbook could be an attempt to "lead the reader by the hand" towards the representation of the cell, which is quite distant from an idea of "body parts". The Singaporean textbook, on the other hand, makes higher demands of the readers' capacity for abstract understanding right from the start.

As regards images presenting content that is also mentioned in the body text, various ways of connecting, for instance, terminology to an image can be used to facilitate meaning-making for the reader. One such way is to ensure *spatial proximity* between a term used and the equivalent part of picture, that is, to give verbal comments on the image located relatively close to it. In Fig. 4.5, presenting an image from a popular science magazine, proximity is further enhanced by the use of colors. Arrows or lines between verbal text and image are also commonly used when labeling important parts of an image (e.g. upper right of large spread in Fig. 4.1).

Another important aspect concerns consistency in terminology use between different representations. The use of terminology shown on the page in Fig. 4.1 is consistent throughout the page to the left in the large spread, with specific words like "cell membrane" re-occurring in the visualization as well as in the verbal text integrated in the visualization and in the text presented in other parts of the page. However, a closer inspection of "the cell" in Fig. 4.1 and 4.3 reveals that this concept is depicted quite differently depending on what aspects of the cell are highlighted in the different sections. Such a variation is something which might need to be pointed
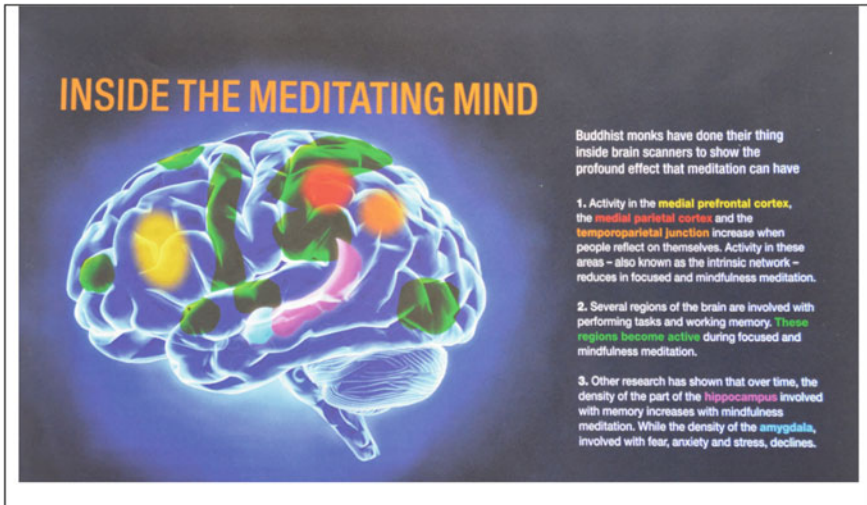
Fig. 4.5 Enhancing proximity by use of color: *BBC Focus Magazine* (Ridgway/BBC Knowledge 2013, p. 71, with permission from BBC Science Focus Magazine)

out in the educational context, and discussions about the different choices can support the students in relation to both subject contentand multimodal literacy.

4.5.3 Figurative Language

As mentioned, there are several reasons to focus on figurative language such as metaphors in relation to multimodality. Firstly, a metaphor in itself can often be seen as a *multimodal ensemble* (e.g. Jewitt 2014). An example is the use of the metaphor "monetary flow" to talk about economic systems. Here the words can lead to a mental visualization of a flow. Secondly, metaphors can be expressed through different semiotic modes in a text (writing, image, etc.). Also, some metaphors are integrated in the content of a knowledge domain (see below) and, consequently, central for meaning-making in that area.

In the following, we discuss figurative language in writing as well as in images, since images in pedagogic texts can be based on metaphors. One such example is the welfare system of a society, where an image could be in the form of water flowing in pipes with the different parts interconnected as in a technical system (cf. "flow of money").

As mentioned, the use of metaphors can also be challenging, for instance in regard to the reach of a metaphor. Also, as regards second language learners, the use of uncommented figurative language can be potentially challenging. This is particularly true when everyday expressions are used (which is often the case with

metaphors, for instance "muscular bag"). For a student who knows the everyday expression, the figurative use can be misleading. Therefore, an important role of the teacher is to "unwrap" the figurative language and to help students to focus on the adequate aspects of the content expressed metaphorically.

In the two texts we have chosen, we can find some interesting examples of figurative language. In the Singaporean text, we are told that glands produce "special juices", and that there is "pancreatic juice", "intestinal juice" as well as "gastric juice" (Figs. 4.2, 4.3 and 4.4). The concept of "juice" is not explained, neither in relation to the everyday language of juices nor in terms of the different kinds of juices within the different parts of the body.

Other metaphoric expressions are "muscular tube", "muscular bag" and "wall", or "how food *travels*" (Fig. 4.2, our italics) through the body. Also, we learn that "hydrochloric acid […] *helps* the protease to work" and that "Long muscular tubes contracts and relaxes, which mixes intestinal juice and pancreatic juice with food, to *help* digestion" (our italics). Apart from being metaphoric expressions, food and muscles also become "humanized" with intentions in these examples.[4]

We can also notice more general concepts like "systems" (for example "systems that form the organism" in Fig. 4.4) and "functions", which have connotations of a machine-like mechanism, where every part has been made in relation to every other part to serve an overarching whole. In the Chilean book (see Danielsson and Selander 2016) it is said that systems of digestion, circulation or nerves "together form the organism". In the Singaporean book, the flow chart of the digestive system in Fig. 4.4 further enhances the notion of a system in a type of visualization.

An interesting kind of analogy is found in the Singaporean text (Fig. 4.3, bottom, left). Here the students are supposed to perform an experiment with water, cooking oil, and washing-up liquid as an analogy for the digestion process when fats break down in the body. In the activity, it is explicitly mentioned that the cooking oil "plays the role of" (i.e. functions analogous to) the fats in the food, while the washing-up liquid plays the role of the bile. However, the analogous role (if any) of the water is implicit.

Discussions about the use of figurative language in a text, including "unwrapping" the metaphors and their reach can function as excellent opportunities for in-depth discussions of content matters (see also Danielsson et al. 2018).

4.5.4 Values

Value statements are a part of human communication. Sometimes values are openly declared, and we can simply agree or disagree with them. But equally important—or

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[4]Such *anthropomorohic* metaphors have been noted in previous research in science classrooms (see for instance Tibell and Rundgren 2010, Danielsson et al. 2018). In a recent study, Pettersson and colleagues (2020) noted a great deal of anthropomorpisms when students were asked to describe the digestive process in a national test.

perhaps more important—are the more implicit or tacit values in a text. In these cases we need to scrutinize the ways in which the information is presented, and what kind of information is left aside.

In the two texts we have analyzed here, explicit articulations of values are not frequently used. But one example can be found in Fig. 4.3 (right) under the sub-heading "Think and explore". The text states that "Some teenagers become obsessed with losing weight […]" and then follows a warning concerning possible dangerous consequences such as eating disorders (anorexia and bulimia), which might cause "life-threatening conditions" such as "muscle weakness, kidney damage, heart failure and even death if left untreated".

Implicit values are of course more difficult to detect, since they very much depend on the perspective from which the text is interpreted. Here we would like to point out some interesting examples. Curriculum documents often state that historical links should be made in different content areas, though exactly what historical links are supposed to be offered the students might not always be stated. In the Singaporean text a historical connection is made through some information about Dr. William Beaumant, here highlighting his efforts and curiosity, while the fact that he used a live person for his experiments is not problematized (Fig. 4.1, right). Another example of implicit values is the conceptual hierarchy (Fig. 4.4, right), which shows how different concepts are interrelated and, implicitly, how scientific conceptualizations should be organized in more or less general terms. In this case, the text shows us what kinds of representations are valued in scientific work. The hierarchy is also a way of pointing out the role of scientific concepts in relation to the everyday use of different terms.

It is important for students to become aware of the ways in which values can be more or less hidden, in order to prevent them from being manipulated by texts and for them to develop their critical literacy (Luke 2000). Also, by highlighting implicit and explicit values in texts, interesting discussions connecting to the students' own life experiences can be made possible. Even though values can be commented on in relation to any text, this might not be the most important aspect of the two texts in focus here. In the second part of this book, however, we have analysed texts taken from history and religion (Sects. 8.5 and 8.6), which are subjects that are particularly interesting concerning values.

4.6 Summary

In this chapter we have focused on educational perspectives of multimodal texts, and we have also presented a model for working with such texts.

The fact that different multimodal texts and different text genres or texts in different subjects can be challenging for the reader in different ways must lead to an extended view of the development of reading and writing. From such an extended perspective, "learning to read and write" means developing different *repertoires* regarding different genres as well as texts in different subject-specific contexts. The

way that "the expert" can interpret texts is different from that of the "novice". For example, a person who possesses great knowledge in a field will fill in potential gaps in a text, in ways that the novice cannot do. Therefore, a teacher with a profound understanding of the content area might not always realize the potential challenges regarding the interplay between textual resources such as writing and various kinds of illustrations. Hence the expert might need tools to make visible the challenges implied in a text, in order to support novices in their encounters with texts.

A number of methods for working with reading have been developed previously, though most of them focus on verbal language. Our model focuses on the *multimodal text* and how to work with such texts in education. In the last section of the chapter, we have presented our model for work with multimodal texts, alongside a presentation of the different aspects of the model by analyzing two texts, focusing on (1) the general structure of the text, the thematic orientation and sequencing, and the different text resources used; (2) the interaction between the various parts of the text, such as visual proximity and congruence as regards the contents of the text; (3) figurative language, such as analogies and metaphors; and (4) explicit or implicit values.

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Chapter 5
Cultivating Students' Text Creation

Work with multimodal texts as described above is also relevant for students' own text production. Furthermore, parallel to the importance of knowledge about multimodality in regard to students' meaning-making with pedagogic texts, there is a need for an enhanced knowledge of multimodal writing practices, and how to support students in their writing development. Also, teachers need ways to assess students' multimodal products in fair and relevant ways. Such questions have been discussed within the field of New Literacy Studies (e.g. Bearne 2009; Cope and Kalantzis 2000), though it appears as if teachers feel that they lack the tools for working with multimodality (Bearne 2009; Engblom 2011). Nurit Peled-Elhanan (2015) noted that teachers tended to see children's use of images as "lack of capability, a transitory phase or waste of time" and she concluded that "[a]lthough most of the texts children read at school are multimodal they have no license to develop multimodality in their own texts" (Peled-Elhanan 2015, p. 275). Based on discussions in the field, we will give an example of how to use our model in relation to the students' work with their own multimodal texts.

5.1 Writing Practices in Schools

In school, students are involved in a variety of writing practices. They might have learned that they can underline text or use other ways of highlighting important text passages, they make their own notes and drawings, or they take photos of the teachers' written expositions. This is a kind of private writing, used for the student's own thinking processes and seldom intended for anyone else than the student herself.

The log book is another form of writing which is something in between private reflections and the more official writing practices of the school as an institution. In the log book, private experiences from the teaching, perhaps including reflections on social aspects of the learning situation can be mixed with notes of direct relevance to the subject content.

Examples of more or less public and visible writing activities are experimental reports or other kinds of written presentations connected to the subject content (these reports can be presented through PowerPoint presentations, Internet pages, wall posters, etc.), essays, or compositions. Such writing activities are supposed to focus mainly on what is highlighted in relation to the subject content. Genres such as the experimental report are fairly standardized, while the essay gives room for more variation and personal comments.

One crucial question is what kind of writing best supports the understanding of subject content. It could be claimed that all kinds of writing are beneficial for students' learning, no matter what it deals with or what kind of writing is involved. An argument against such a position is that too much emphasis on, for example, log books, can lead to a situation with many unstructured texts, something which can be counterproductive, considering the expectations on other texts, such as written reports. Therefore, teachers need to be explicit about the didactic function of the texts when students are asked to produce texts: is the text supposed to be a thinking tool, or will it be used for communication with others about the subject? For the latter type, explicit instruction and joint text construction (cf. Rose and Martin 2012) can harness the students' writing process and their development of metatextual competencies. When working with texts intended to communicate with others, the natural starting point is the function of the text: why should it be produced, and who is supposed to make meaning from it? With such a starting point, a number of choices will need to be made concerning what aspects of the content to include, and how to express different aspects of the content (cf. the central questions of *why*, for *whom*, *what*, and *how*?). Also, anyone who produces a text can decide whether to "play it safe" and adhere to genre expectations, or whether to challenge them.[1] From a multimodal point of view, it is then important not "only" to focus on linguistic choices, as is often the case in, for instance, genre pedagogy where joint text construction is a central didactic tool. Instead, choices in regard to other modes should be equally focused. A central idea, then, is that every choice concerning *how* is always tightly connected to *why* and *what*, where *why* should always be the starting point (see Bergh Nestlog and Danielsson 2020).

5.2 Linear Writing and Multimodal Composition

In text traditions based on written language, you write, for instance, from left to right or from right to left (that is, in cultures based on such orthographies, such as English, Spanish, Hebrew, Arabic). One consequence of the written language bias is that the writing structures have evolved based on words, clauses, and text sections, with different kinds of punctuation or emphases. Writing in such cultures follows a

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[1] This can be connected to and idea of a "double dialogue" (cf. Evensen 2002, who draws on Bakhtin), namely the idea that when producing a text we are interacting both with the one(s) that the text is intended for, and with conventions in regard to similar texts (genre expectations).

kind of time line characterized by "first… and then" or thematic structures where the point of departure (the theme, or what is already known) in a clause is mentioned first, while new information is placed at the end of a clause (Halliday and Matthiessen 2014). If you state, for instance, that "Sarah and Kim have just bought a new house" you presume that Sarah and Kim are known to the reader or listener, while the fact that they have bought a new house is presumed to be new information. If we instead say that "The house was sold by Sarah and Kim", we then have another perspective. Here it is presumed that the house is already known to the reader or listener, and perhaps also that fact that this house is about to be sold.

In linear writing, a number of significant features have been developed in relation to different text types or genres: the structure of the short news item is different from that of the editorial, an explanation is different from a descriptive or narrative text, and so on (e.g. Martin and Rose 2006). Such recurring structures are taken into account in genre pedagogy. As opposed to linear writing, texts built on visual elements have a different structure, based on spatial orientation, where elements with a central placement or which are big in size or taken close-up receive greater weight than elements placed on the periphery, or viewed from a distance, where the choice of a schematized representation or a representation of higher fidelity can signal different levels of scientificness (see Kress and van Leeuwen 2006).

As we discussed Chap. 2, different kinds of resources or semiotic modes are better apt for different kinds of communication or ways of conveying knowledge, as is illustrated in an example reported by Kress (2010). After a visit to the British Museum in London, pupils were asked to use images and writing to make a text about their experiences. One boy gave a relatively detailed, temporally based, narrative about practical things like the fact that first they left their clothes in the cloakroom and later picked them up, that they used the elevator to get to the exhibition, and that they went home by tube and train. He used one sentence to report from the exhibition: "Then I went to see the mummies and all that stuff". Thus, in writing, he described a lot of details in relation to the visit, but in his drawing he chose to portray the mummies. In this case, the image was used to focus on something the boy found quite spectacular, perhaps because the mummy trigged his engagement and fantasy in a way that he could not express in the narrative (Kress 2010, also see van Leeuwen 2000).

However, regardless of the actual reason why this boy chose to draw the mummy, in a classroom discussion, the teacher could discuss different things; for example what the boy had chosen to present through the different resources, what aspects of the mummy he found particularly interesting, or what details were especially salient. Here, the image, rather than the written narrative, would be the natural basis for assessing the boy's knowledge about mummies, and consequently, his knowledge of ancient history.

5.3 Towards a New Understanding of Writing

In the multimodal text, the logic of writing is usually mixed with the spatial logic of the image. Different types of information are given through different resources. Hence, today, writing is a process of *composing* a text, combining different types of text resources to form a coherent text. Such a composing process will be different from composing a text entirely based on more traditional writing. Therefore, when composing a multimodal text, a number of choices are important. For example, it is important to decide what semiotic mode to use to express what aspects of the content, or if the content given through different text resources should complement, or overlap, each other. Apart from that, choices have to be made in relation to typeface, size, and colors in images or other visual resources, and where to place them in relation to each other. For anyone interested in reading more about multimodal composition, we refer to literature that can enhance the semiotic analysis (e.g. Kress 2010; van Leeuwen 2005, 2011).

In a text based on writing, we normally presume that the text is formulated by the author and if parts are taken from other sources, quotation marks should be used and the source needs to be stated. However, this has not always been the case. When the printing of books was developed, books could consist of compilations of a variety of texts, and thus, the role of the author was more of a "text compiler" than an author in a modern sense (Swann 2001/2010). A similar approach is today's ways of handling digital texts, where compilations and combinations of texts are mixed with texts written by a sole author (for example the case of *fan fiction* which was mentioned above). Therefore, for teachers it is important to ponder over how to approach the use of different sources in students' texts.

In Sect. 5.1 above, we mentioned that in the text traditions of (Western) schools, students in lower grades have been encouraged to combine writing with image. For the really young children, image is the main source of meaning, while the verbal text can be seen more as a backup or illustration (not seldom with a grown-up or older child who can act as the writer for a couple of words or sentences). Later we can note a shift, and in school the pattern is the reverse, with the function of the image being more of an illustration to the writing. In lower grades, this tradition is strong regarding both narrative and more expository texts. In higher grades, the image used as an illustration is of less and less importance. However, in natural sciences or the social sciences, for example, writing is often combined with graphs, tables, diagrams, or images that show various parts of experimental work. Thus, for students to create multimodal texts is by no means something new. What is new, though, is the availability of digital media in schools, which makes it possible to gain access to an infinite amount of data, and to communicate through and produce multimodal digital texts.

The digital world offers, apart from written texts, an enormous amount of images or film clips which are freely available for download. It is fairly easy to use images, and to combine image with writing, and to give information in images or series of images as well as through writing. However, it is not always straightforward to

get information about where an image was originally created or by whom. For the teacher, it is somewhere along this line that the students' understanding of content arise. These challenges can be dealt with in different ways. In some schools where they have chosen to invest in *one-to-one* projects (one computer or tablet for each student), students are encouraged to work with subject content through digital technology, while test situations are traditional, based on pen and paper (Åkerfeldt et al. 2013). A question that arises in relation to such practices is whether they really imply an understanding of the students' knowledge, or if this way of working only rewards a type of knowledge and representations of knowledge that is best shown through verbals (writing or perhaps speech). These kinds of questions are even more prominent when the next generation of digital projects become more common in schools, such as in *one-to-many*-projects, where the students themselves can choose what digital resources to work with.

Hence, the multimodal text world offers both new possibilities for communication, and new challenges regarding the texts produced. Texts are redesigned and composed in new ways, and one more complicating factor is that texts that are produced in school do not stay just there. An increasing amount of texts are made available on the Internet. Thus, there could be one culture in the school in relation to school assessement, and another one outside of school, based on the student's individual interests. Examples are Internet communities for *fan fiction* or sites like www.poetry.com where one of the incentives for publishing appears to be the—often very positive—assessment from other members of the community. This in turn implies that new criteria for cultures of assessment need to be developed, based on the communicative situation in which the text is created and used (cf. Kalantzis and Cope 2000; Kress and Selander 2012).

5.4 Supporting Students' Work with Multimodal Texts

With minor modifications, our model for multimodal text analysis presented above can be used for supporting students' text creation from a multimodal perspective, both paper-based texts and those created through digital media. To support students' composing of such texts entails supporting both their content knowledge and their abilities regarding the use of different resources for meaning-making and communication.
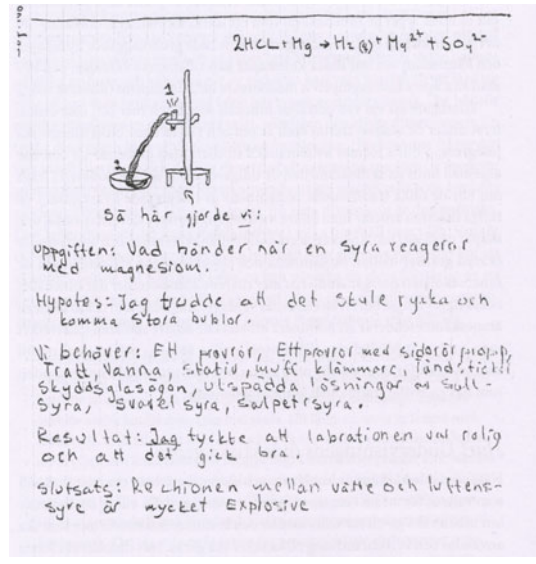
We think that some aspects are especially central: the *general structure, choice of semiotic mode* in relation to the content, and *the interplay between different text resources.* These aspects are connected to *General structure* and *Interaction between parts of the text* in our model. These different aspects of the text must here be related to both the function of the text, including the intended reader, and the content. A text created mainly for the teacher, with the intention to show one's understanding of a specific content in relation to the curriculum, or other explicit objectives of a course, has to meet other demands than a text created with, for example a fellow student as the intended reader.

Our model makes it possible to go deeply into, among other things, different aspects of multimodal texts presented by Eve Bearne (2009). Her model for assessement includes the choice of semiotic mode in relation to text function, intended reader, text structure, and the use of different (technical) resources for communicative effects.

Another aspect, according to Bearne, is connected to an overall *meta-reflective* ability in relation to texts and multimodality. In this case it concerns the students' ability to reflect upon and enhance their own competence in handling multimodal texts. We claim that conscious work with text based on our model can contribute to the development of students' meta-reflective abilities.

In the following discussion of the development of multimodal abilities, we proceed from the various parts of our model, using a student text (Fig. 5.1) as an example. This student text is taken from a book on text work by Liberg and colleagues (Liberg et al. 2010, p. 16) and it was created in relation to experimental activities in a science classroom. Liberg and colleagues do not comment on the student text as such; instead it is used as an example of a text created in science classrooms. We also relate our discussion to the student text from grade 2 which is shown in Fig. 3.2, Sect. 3.3, above.

When discussing student texts, it is important to consider the situation and the conditions prevailing in relation to the production of the text. If students in a chemistry

This is what we did:

The task: what happens when an acid reacts with magnesium?

Hypothesis: I thought that there would be smoke and big bubbles.

We need: A test tube, A test tube with side tube, a funnel, dish, tripod, sleeve, clip, matches, protective glasses, dilute solutions of hydrochloric acid, sulfuric acid, nitric acid.

Result: I thought that the experiment was fun and that it went well.

Conclusion: The reaction between hydrogen and the oxygen in the air is very explosive

Fig. 5.1 Experimental report from a science classroom in secondary school, written by hand (Liberg et al. 2010, p. 16, with permission from the authors)

classroom are told to write an experimental report without having worked with such texts before, one cannot expect all students to be able to handle the different genre-specific requirements that could be expected in this kind of text, neither in relation to text structure and word choice, nor regarding the use of other text resources such as images, symbols, etc. One example from the text in Fig. 5.1 is the text under the heading "Result" (Sw. *Resultat*) where the student has written "I think that the experiment was fun, and I think that it all went well". This is an adequate way of formulating the results, at least for students who might be familiar with log-book writing with self-assessment and reflections about their own achievements. Yet this comment says nothing about the understanding of the results in the experiment regarding chemical reactions and so forth.

We have only limited knowledge about the context in which the text in Fig. 5.1 was produced. In regard to the text in Fig. 3.2, however, we know that the text was written after an excursion to the seaside. When the students came back to school, they were asked to write a text about the excursion, and as a kind of inspiration, the teacher had brought some examples of animals that could be found by the sea, and put them into an aquarium. We do not know, however, anything about the extent to which the students in this class had focused on the ways in which writing and images can be combined, but from Sjøhelle's (2013) description, our impression is that this was not the case.

Thus, regarding the experimental report, we do not know much about the situation in which the text was produced, but from our general knowledge about teaching in science classrooms we can mention a couple of relevant aspects to have in mind in the following. First, science classrooms are highly multimodal learning environments, containing subject-specific artifacts such as three-dimensional models of atoms and molecules, charts of the system of elements which combine writing with symbolic language, and so on. (e.g. Lemke 1998). Furthermore—as in the situation in which this student text has been produced—experimental work is quite frequent, and during such activities experimental equipment, such as Bunsen burners, test tubes, tripods, tongs, and evaporation bowls are used. Also, the experiment is often preceded—or succeeded—by a theoretical exposition through writing, teacher talk, gestures, blackboard notes, and more (e.g. Danielsson 2016).

Experimental reports written in schools have been described repeatedly (e.g. Knain 2005; Kress 2003) and in many science classrooms students receive some kind of text model to use when writing such texts, at least proceeding from a number of more or less logical headings. Examples are Hypothesis, Procedure, Equipment, and Conclusions. If we look at the text in Fig. 5.1, it seems as if this student uses such headings, and we can assume that the teacher has provided the students with them. It is also common for students to be expected to combine writing with images in their reports, for instance to visualize how the experiment was performed.

From a multimodal perspective, it is relevant to take a closer look at the choices regarding what to present through what semiotic mode. This is specifically interesting in regard to how subject content is handled through the different modes, and how the text as a whole reflects the understanding of content. The shift in modes from the hands-on activity (the actual experiment) to a written report is an example of

transduction (Kress 2003). This means a transformation of content from one semiotic mode to another (in this case from a hands-on activity to image or writing; in other cases transduction could involve spoken verbals and writing, or images and writing). When, on the other hand, the shift is made within the same semiotic mode, for example when students are expected to "use their own words" when writing a new text, for example from a text on the Internet, this is an instance of *transformation* (e.g. Kress 2003). These types of shifts can be quite challenging for students, and anyone who creates a text needs to be conscious of the different affordances (or possibilities and limitations) of modes to be able to make well-balanced choices.

5.4.1 General Structure and Setting

Regarding the choice of semiotic mode and content, the author of a text has to make a number of choices about what content is best expressed through what semiotic mode or resource. These choices are made in regard to the available modes, which in turn depends on factors such as whether the text is paper-based or digital, but also in relation to how well you can handle the medium or resource in question (in Sect. 3.2, "What semiotic modes 'count'"?, we described how a young student made a spelling mistake to make an image appear in the right place of the page).

The examination of choices of semiotic modes is connected to the *affordance*, or meaning potential, of resources (see Sect. 3.3, above) and to the choice that may be best in relation to the function of the text and the (intended) reader.

In the student text presented in Fig. 3.2 (Sect. 3.3), a primary school student chose to draw a crab, but he used words to report that it moved sideways (furthermore, through his words he made a general statement: "crabs move sideways"). These are well-balanced choices in relation to the meaning potential of semiotic modes. Also, the teacher has good reason to utilize this, perhaps implicit, knowledge in future text discussions on the choice of semiotic mode (expressed in other words, of course) with this student. Here we want to comment on the fact that the student actually colored the crab red, which cannot be shown in the black-and-white reprint. It is most likely that the crab that they found during the excursion was gray/black rather than red. The fact that the boy colored it red—which is the color of a cooked crab—can perhaps be explained by the fact that crabs in children's books and animated films are usually red, or the boy might have eaten crab at home. It could also be the case that the crab that he depicted was actually red. According to the description of the context in which the text was created, the teacher had put a number of things in an aquarium as a kind of inspiration. It might be that this was a red toy.

When writing an experimental report, there are also reasons to combine image and words. Images can illustrate what kind of equipment was used, or how an onion

that was used for dissection looks in a microscope (e.g. Kress 2003).[2] Hypothesis, results, and the procedure around the experiment can then be expressed in words.

In the experimental report shown in Fig. 5.1, the student has used a variety of sign systems: chemical symbols, a drawn illustration also including figures and words (in a caption), writing in the form of body text which has been organized in a kind of bullet structure.

If we look at the text in Fig. 5.1 in regard to general structure and sequencing, the text appears to be in line with the experimental report as a school genre. The combinations of sign systems (*chemical symbols, image, writing*) is typical of the genre, and the overall impression is that this is a fairly well-structured text.

A next step in the process is to take a closer look at what is offered through the different visual resources, or what content is given through the resources and how they are used. On the top of the text, the student has used chemical symbols to write a *chemical equation.* The use of such symbols is typical of the disciplinary discourse, where chemical symbols are used to express how substances and different compounds react, and what new subjects or compounds are formed during the reaction process.

Below the chemical equation, the student has drawn an image of the equipment that was used during the experiment, and how the different parts were put together. Here we can see a tripod with something that looks like a test tube (marked "1") which is fixed to the pipe through a clip. Beside the tripod is a bowl (marked "2"). Between the test tube and the bowl is some kind of pipe. The drawing, too, gives the impression of being in line with the genre of experimental report. The writing has been sequenced in sections according to (presumably) given headings, such as "The task" (Sw. *uppgiften*), "Hypothesis" (Sw. *hypotes*), and "Conclusion" (Sw. *slutsats*), which of course is in line with what can be expected, given the genre.

As a whole, the examination of the general structure of this student's experimental report, gives the impression that the student has created a text that is in line with what can be expected of the genre in a general sense, for example through the use of different semiotic modes such as chemical symbols, image, and writing. The writing is also presented in line with genre conventions, with headings, text in bullets, and a caption below the drawing.

5.4.2 Interaction Between Text Resources

Apart from examining the interaction between the different textual resources, we have elected to include the choice of resource in relation to subject content and intended reader. Such considerations could also have been remarked on under the previous heading, general structure, where we commented on what content different text resources offer the reader.

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[2]Kress (2003, pp. 109 ff) describes the ways in which students' visual representations of the onion can be related to the ways in which the teacher had talked about the cells forming patterns, similar to a brick wall.

Among other things, we here look at the coherence between content given through the different resources and how they complement or overlap each other. If we return to the student text in Fig. 3.2, we can note that, apart from describing different aspects of the crab through image, and words, the student has used images and words to describe the bad weather during the excursion (a drawing of a sad sun combined with the words "grumpy wind and waves" (No. "*sur vin og bølge*"); here the student has also used arrows to mark the change in weather when the sun is disappearing and the clouds are coming into the picture). Apart from that, images are used to show what the pupils found during the excursion, while in words commenting on things such as the fact that a snail stuck to everything ("I have found a snail which stuck to everything" No. "*Jeg har funet en snegle som sugde sig fast på alt*"). Such information is hard to give through the image.

In the experimental report, the chemical formula that is written on top of the page is only implicitly connected to other parts of the content. Anyone who knows chemistry knows that "Mg" corresponds to the word *magnesium* which is given further down in the text, under the heading "The task" (Sw. *Uppgiften*), and that "HCL" (the gas hydrogen chloride) in this case must correspond to "an acid" (Sw. *en syra*) (HCl) in the same section. Furthermore, subject knowledge in the area of chemistry is also needed to be able to grasp that the formula only concerns one of the acids that are mentioned under "We need" (Sw. *Vi behöver*), here the solution hydrochloric acid (Sw. *saltsyra*) which corresponds to the chemical bond hydrogen chloride dissolved in water. The fact that the image is probably linked to the formula is not made clear (the formula should be the theoretical connection to the actual experiment). Hence, there is some degree of correspondence between the different resources, though on the whole this correspondence is only implicit.

Below the image of the experimental equipment, the text says "This is what we did:" (Sw. *Så här gjorde vi*) with an arrow pointing towards the drawing. The information given through writing here implies a description of a process. However, the drawing is implicit as to how the experiment was actually performed, and only a person who was present during the experimental work (or who knows how this kind of experiment is normally performed) will be able to understand what was done. On the other hand, the drawing works fairly well to illustrate what equipment was used, and how the different parts of the equipment were connected.

Thus, the drawing works well in relation to its potential for meaning-making, or *affordance*, in this case to illustrate spatial relations and to depict concrete objects. On the other hand, the caption "This is what we did" implies a description of a procedure, something which would have been easier to express through writing. Further down in the written text, under the heading "We need" (Sw. *Vi behöver*), some of the equipment depicted in the drawing is mentioned: "test tube", "burner", etc. Figures 5.1 and 5.2 in the drawing are not explained, and they do not appear in writing. Hence, we note that there is some coherence in the text, but the connection between the content given through the different resources is implicit.

Since we do not know the context in which the experimental report was produced, we do not know for sure who the intended reader of the text is. Presumably, it is written for the student himself, and if so, most likely to be used in preparations for a final test.

Or perhaps it is supposed to be handed in to the teacher for assessment; or possibly a combination of the two.

Regarding the use of chemical symbols, the text is problematic if it is intended to be used as a basis for understanding the content area, since the chemical formula is not explicitly explained. For the same reasons, its usefulness can be doubted, if the text is intended to be used for assessing the student's content knowledge.

Regarding the image in relation to other resources, the text can perhaps be used to remember how the experiment was performed (however, here it is unclear what the numbers 1 and 2 stand for). If used as an assessment of how the experiment was performed, or as an instruction to someone else who is about to perform an equivalent experiment, it is less functional.

Furthermore, the written text presented in bullets is not unproblematic either, as regards content or genre expectations. What is given under the heading "Results" (Sw. *Resultat*) is expected to be connected to the actual experiment, for example, "there was a strong reaction in which oxyhydrogen was formed". Instead, the student wrote "I thought that the experiment was fun, and it went well". However, under the heading "Conclusion" (Sw. *Slutsats*), the student states that "the reaction between magnesium and the oxygen in the air is very explosive", which is more in line with what we can expect from the genre.

5.4.3 Figurative Language and Values

In this particular text, an analysis of figurative language or values is irrelevant. Regarding figurative language, we may note that such expressions are not used (in words or images), and values are hardly expected in an experimental report. Yet, values are relevant in science, too, for example in relation to the use of natural resources or if it is reasonable to kill animals in order to use them for dissection in the classroom.

In analyses that have previously been performed on student texts from chemistry classrooms (Danielsson 2011) and in lower school grades (e.g. Kress 2003), the use of figurative language has been noted. In those cases, the figurative language, such as "Noble gases are contented" or "the structure of the cells in the onion is similar to that of a brick wall" were inspired by the teachers' oral expositions. If figurative language is used in class, it is important to evaluate whether the metaphors used are in line with the metaphors used in the disciplinary discourse, as well as whether an analogy seems to be both relevant and transparent.

5.4.4 The Subject Content

From the perspective of the school subject, the subject content given in texts is central, and it is therefore natural to focus particularly on content when working

with text creation in different subjects. In the experimental report, we have noted that many resources have been used in adequate ways, for example regarding genre expectations. Yet we still cannot be sure whether the student possesses the content knowledge that the teaching and learning activities staged by the teacher probably aimed at. The fact that the chemical symbols are used in line with subject conventions does not automatically imply that the student also knows the content behind the symbols.

Under the heading "The task" (Sw. *Uppgiften*), the student has written "What happens when an acid reacts with magnesium?" (Sw. "*Vad händer när en syra reagerar med magnesium*"), which is most likely the same expression as was used for this particular task. If connected to the use of chemical symbols, it could very well be that the student knows that "HCL" (correctly written: HCl) is an acid (probably the solution, if taken into account what is written under "We need", since hydrogen chloride, Sw. *väteklorid*, is a gas). But from the text it is not clear what acid "HCL" corresponds to (three different acids are mentioned in writing). Also, someone who knows chemistry can conclude that the chemical equation on top of the page is not balanced. The formula does not reveal how the sulfur ion was formed, or what happened to the chloride.

5.4.5   Developing Multimodal Text Competence

The analysis of the student text in Fig. 5.1 reveals that this student possesses a good knowledge of the structure of the experimental (school) report at a general level. When working with the development of this student's multimodal competence, this knowledge would be a natural point of departure.

A subsequent step could be to discuss in more detail what semiotic mode or specific text resource is best fit to express different aspects of the task at hand. One example could be to ask the student to reflect upon the use of a single image to describe the process "this is what we did". In this case, some information would clearly be needed to be given through words. Also, the text could be used as a basis for pondering on ways of making the text even clearer regarding the ways in which different text resources interact. One such example could be to complete the chemical equation with a description of what it shows, given through words. Here it is important to discuss different choices as to semiotic mode, or as to details of the text resource chosen in relation to the function of the text, and in relation to the intended reader. If discussing multimodal aspects of texts in such ways, the student will get tools to enhance the text in ways that will better show the teacher his understanding of content, as well as for himself when producing texts that can be used for developing his subject knowledge.

When using the student's text to discuss the content, it will most likely be evident to both the teacher and the student in what ways the student might need to develop his content knowledge in relation to the experiment, and to what extent he "just" needs to develop his multimodal text competence. Hence, these two aspects are

interdependent. In classrooms practices where teachers support meaning-making in relation to multimodal texts, students will be supported in their development of content knowledge at the same time.

5.5 Summary

The multimodal text perspective has a direct relevance for students' own text production. Just as we need a deeper understanding of the ways in which students interpret multimodal texts, there is a need for a deepened understanding of *multimodal writing practices* and how students can be supported in their own writing development in relation to multimodality.

In schools numerous writing activities take place, such as memos, lab reports, logs, PowerPoint presentations, web pages, posters, and essays. These writing activities are related to subject content and the different genres or text types in the area. The lab report is usually relatively standardized, while other types of presentations of subject content, or the essay, can be more varied and contain personal reflections.

In the *multimodal text* the temporality of the verbal text is mixed with the spatiality of the image. Therefore, different kinds of information are given through different resources, and to *compose* a multimodal text thus implies something other than composing a verbal text.

By using our text model for analyzing and discussing an experimental report created by a student, we have seen that the student masters the genre at a general level. From a superficial point of view, the text looks like the way we are used to see such reports. However, by looking closely at the ways in which the student has used different semiotic modes and resources and how they interplay, potential obstacles for the student were revealed. We suggest that teachers proceed from what the student masters when discussing student texts. From there, they can discuss how the different semiotic resources are used (images, chemical language, verbal language, etc.) and why. With such a discussion, focusing on text *and* content, possible challenges for the student regarding the content can be revealed at the same time as the student's multimodal competence can be enhanced.

The ways of producing and handling texts in the digital world brings other aspects to the fore, as when other texts, images, or films are merged in new texts. As a teacher, you need to consider how to deal with references to other sources. Such questions will be even more important when new ways of using computers in schools become increasingly common, for instance in so-called "one-to-many" projects, where the students themselves can choose what digital resources to use to meet the standards in school.

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Part II
Sample Texts Analyses

Chapter 6
Close Reading of Multimodal Texts—Sample Analyses

In the second part of the book we use our model as analytical tool for texts taken from various school subjects. Here we aim at revealing how a systematic close reading can be used for "wrapping up" a text, in order to make visible how different semiotic resources are used in ways that can both be facilitating and challenging in the meaning-making process around the content. However, we also want to show how teachers can work with a text to make it more accessible and easier to grasp for the reader (in this case, the student). In the analyses we focus more closely on different aspects of the model depending on what we find especially interesting or challenging in the various texts. Also, what the teacher might want to highlight in metatextual discussions must vary, and the same text might be discussed in many different ways, depending for instance on how experienced the students are when it comes to metatextual discussions and multimodal aspects of meaning-making. In the following we give some examples as to what can be highlighted in text discussions. Such comments are either given under a separate heading or in parallel with the analysis. However, these comments should be seen as suggestions and they are not extensive or given in relation to each and every text. In classroom practices, the teacher will choose what features to focus on in the texts used. Our suggestions as to what to discuss can then function as an inspiration.

This type of close reading will partly be very detailed, and it might acutally be perceived as "over-critical". However, it is not our intention to be critical in negative ways. Instead, we want to point out aspects of texts that are relevant for all kinds of multimodal texts. To write a text and to make decisions about the layout and choice of text resources is challenging, and a number of choices need to be made. Each choice will result in both gains and losses, something which is inevitable. But when teachers have a more robust approach to multimodal texts, they can better support students in working themselves through texts.

We suggest that you start reading the sections that deal with subjects that catch your interest. You can consider the sample analyses as a supply of resources for inspiration. Our examples are never fully exhaustive, and with the help of the model you might be able to find further interesting aspects that we might have neglected.

As already mentioned in the Introduction section, in our selection of texts for analyses, we have striven to include as many subject areas as possible, and we have used texts from different school levels, even though the emphasis is on texts used in upper elementary and lower secondary school. During these school years, texts are relatively complex. For lower school grades, texts in science are relatively similar to those analyzed here, even though they are less complex regarding verbal aspects (less complex clauses and terminology, etc.). Focusing on what information is especially emphasized through writing or image, as well as the use of figurative language, or values in texts can just as well be carried out in lower elementary school grades. The textbooks in upper secondary school, on the other hand, are of course more complex and they have a deeper content, but at the same time they do not differ from texts in lower secondary school in major ways. Also, our examples are mainly based on printed books. One reason for that choice is that printed textbooks (or digital texts based on printed versions) still dominate the market in many countries. Here, however, we can expect a shift in the near future. As regards examples from different countries and cultures, we have tried to find a variety. Since this book is written in English, quite a few of the examples have been taken from English-speaking countries (in this case the UK and Singapore), but we also use examples from Chile, Spain, and Sweden. We ourselves are Swedish, and thus we have access to a variety of teaching resources as well as an insight into the educational system. When examples with other languages than English are used, we provide the reader with translations of central parts of the texts.

The aim of the close reading of these texts is to provide the reader with detailed examples from a variety of school subjects. Yet this does not mean that the close reading is fully exhaustive. Our model is dynamic in the sense that different learning resources can be analyzed by means of the concepts used in the model. As said, this does not mean that there is one, and only one, way of analyzing or working with these texts or working with students' interpretations of them. Our close reading of these texts should be seen as a kind of modeled reading, where you can choose to put more or less emphasis on the different aspects, depending on the intention behind choice of text, or your planned meta-textual classroom discussions.

Chapter 7
Natural Sciences

7.1 Physics, Elementary School

We have chosen a section dealing with the "the celestial bodies in the solar system, and their movements in relation to each other" as an example of a text in science for elementary school (students aged around 10 to 12 years). This particular text deals with how to explain day, night, months, years, and seasons, which is a central content area for Swedish school children of this age. Here we will make a close reading of a couple of pages in the textbook *PULSFysik och Kemi* (Sjöberg and Öberg 2011) (Eng. "Physics and Chemistry"), and a chapter called "Astronomi—ett himla stort ämne" (approximate translation into English to preserve a wordplay: "Astronomy—a subject full of space").

To start with, we can conclude that to be able to grasp this content, the student must have an abstract understanding of the celestial bodies that we can experience in a concrete way in our everyday lives (the earth, the moon, and the sun). Therefore, in the close reading of this text, we will mainly concentrate on the *general structure and setting* and *the interaction between parts of the text*. We will, however, also comment briefly on figurative language presented in writing, since metaphors are central for science.

7.1.1 General Structure and Setting

Together, the images in Figs. 7.1 and 7.2 constitute an introductory book spread of the chapter. As regards the setting of the spread, we may note that the pages consist of a variety of text resources (various headings, an introductory paragraph, running text, etc.). The illustrations, comprising a photograph and some drawings, are prominent, and they take up a large part of the book pages. The drawings show, on the one hand, children (they reappear in the whole textbook, as interested experiencers, thinkers, etc.), on the other hand schematic images of the movements of celestial bodies.

ASTRONOMY – a subject full of space

Since ancient times, we have used the stars, the sun and the moon to keep track of the time. The sun rises in the morning, moves across the sky during the day, and sets at night. In this chapter, we will take a closer look at how the sun, the earth, and the moon move in relation to each other, why we get day and night, and how different seasons arise. We will also become familiar with other parts of the solar system.
(approximate translation of the bolded introductory paragraph)

Fig. 7.1 Astronomy, elementary school. *PULS. Fysik och kemi 4–6 grundbok* (Sjöberg and Öberg 2011, p. 90, illustrations by Jenny Karlsson; re-printed with permission from Natur & Kultur)

Even from a quick description like this, it is evident that these are quite typical book pages considering the subject and the intended readers. We can also note that illustrations appear to be important, both for illustrating the subject-specific content, such as the drawings of day and night on the earth, and for alleviating the visual appearance (the children who are given various roles, at the same time as the readers can identify themselves as becoming scientists through them).

The chapter is structured *thematically*, in ways that give the reader an overview of the content, stated in the introductory paragraph in bold. Here, the point of departure is the reader's presumed everyday experiences of sunrise and sunset. Also, it gives a historical perspective, informing the reader that humans through history have used the celestial bodies to keep track of time. Such a historical perspective reappears in parallel to the scientific content all through the chapter. In Swedish curriculum documents, it is commonly stated that all subjects should give a historical perspective to the content area in question. The scientific content in this book spread describes how the earth is rotating around its axis, and how this rotation regulates day and night.

Jorden snurrar runt

Det var Nicolaus Copernicus (1473–1543) från Polen som först föreslog att jorden rörde sig runt solen i stället för tvärtom. Det var ett djärvt förslag eftersom det inte stämde med kyrkans läror.

Solen ser ut att röra sig över himlen. Men i själva verket är det inte solen utan jorden som rör sig. Den snurrar runt, och eftersom vi står på den snurrande jordens yta, ser solen ut att röra sig. Och det gäller inte bara solen. Under natten tycks månen och hela stjärnhimlen röra sig på samma sätt.

Jorden roterar ett varv runt sin egen axel på ett dygn. Vi kan tänka oss jordens axel som en lång pinne från Nordpolen till Sydpolen.

Bilderna visar hur jordens vridning gör att vi får natt och dag.

Nu är klockan 9 på morgonen, då är klockan 3 på natten i New York.

Natt i Sverige

Morgon i Sverige
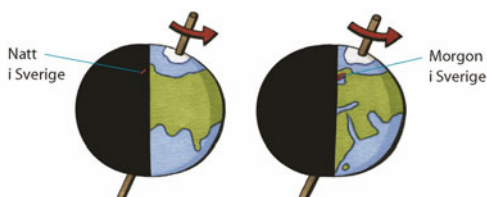
Var vi än är på jordytan rör vi oss åt öster. När platsen där vi är kommer ut ur skuggan ser vi hur solen går upp. Det blir ljust. Men så småningom kommer vi in i skuggan igen. Då går solen ner och det blir natt.

Sommartid

Sommartid innebär att vi ställer fram klockan en timme under sommarhalvåret. På så sätt kan vi få njuta av en extra timme dagsljus på kvällen.

Olika slags tid

Ju längre österut du befinner dig, desto senare på dagen har det hunnit bli. Du vet säkert att klockan kan vara olika mycket i olika länder. Men även inom Sverige märks det skillnad. Solen går upp lite tidigare i Stockholm än i Göteborg.

I mitten av 1800-talet började man använda ångbåtar och tåg och behövde därför trycka tidtabeller. Då var det opraktiskt att ha olika tid i olika delar av landet. År 1879 införde man därför normaltid, som är lika i hela Sverige.

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Fig. 7.2 The earth is spinning around. *PULS. Fysik och kemi 4–6 grundbok* (Sjöberg and Öberg 2011. 91, illustrations by Jenny Karlsson; re-printed with permission from Natur & Kultur)

7.1.2   Interaction Between Text Resources

Regarding the interaction between the different parts of the text, a number of aspects are worth focusing on, not least in relation to *spatial proximity and coherence* between different types of written texts (text boxes, headings, captions, etc.) and other textual representations. The illustrations on the first page are only loosely connected to the

introductory paragraph and the running text. The only clear connection between the resources on that page is the one between information in the introductory paragraph and the drawing of a squatting girl looking at a sundial. For a reader with no previous experience of sundials, this connection might not be clear.

On the introductory page, there is also a caption, placed between the two illustrations: "The earth and the moon move around the sun. When the moon comes in between the sun and the earth, there is a solar eclipse. Here we can see the shadow of the moon as a dark patch on the earth." There is no indication as to what illustration the caption refers to. For several reasons, it is possible that the "novice" will interpret the caption as part of the illustration of the sundial and the girl. First, that illustration is prominent, as regards placement, colors, and composition, while the section from the satellite image is diffuse and may be difficult to interpret. In the first sentence of the caption, three elements are mentioned. For the novice who is not yet familiar with the content, these three elements can be connected to three prominent parts of the illustration with the child and the sundial, namely, the sun, the child, and the sundial. To be able to read three elements into the section of the satellite image, the reader must imagine both the moon and the sun, and also their placement in relation to each other. The part of the text in the caption that says "Here we can see the shadow of the moon as a dark patch on the earth" (p. 90) clarifies that the text relates to the satellite image, and it is also clarified that the image depicts the earth. It is worth noting that the caption contains information about how solar eclipses arise, though this is not mentioned anywhere else in the chapter.

As said, the diffuse section of the satellite image can be challenging to interpret. However, using a photograph, which in this case is intended to show a solar eclipse, is an opportunity to depict a phenomenon which could be hard to grasp otherwise (the fact that the moon casts a shadow on the earth when placed between the sun and the earth). If the caption had been more explicit about the fact that the image was in fact a satellite image of the earth seen from far away, this could have supported the student trying to interpret the image.

The next page deals with the earth's rotation around its axis. Here the illustration has a concretizing function, where day and night are represented by two globes. Combined with the two stylized globes is an analogy that the earth rotates around an imaginary axis. In this case, the rotation around the axis is concretized through a stick supplemented with a curved arrow pointing in the direction of the rotation. Through this illustration, the student is supposed to imagine that the two stylized globes represent the earth at two different times, but also that the stick does not represent a concrete physical phenomenon. Instead, the reader is supposed to understand that the stick has been added as a way of visualizing the tilt of the earth in relation to the sun, as well as the way in which the earth rotates. Thus, the reader is supposed to not to take the stick into account as a real object. Another complication is the fact that the tilt of the earth is not real—there is no up and down in the infinite space to relate to. Instead this tilt concerns the relation between the earth and the sun, which, by the way, is not present in the illustration.

The *congruence* between the information given in writing and that given in illustrations is more apparent than on the previous page. First, in the running text there is

an explicit connection to the illustration through the words "The images show how the rotation of the earth gives us night and day" (approximate translation, p. 91). Second, in writing, too, the analogy between the axis of the earth and that of the stick going from the North Pole and the South Pole is made explicit.

Apart from the assumption that the tilt of the earth should be seen in relation to the sun, there are other potential challenges both in illustrations and writing, and in the relationship between them. Here we will comment on a couple of such challenges. In the illustration there is a slightly curved arrow, a conventionalized symbol to depict a direction or movement.[1] The arrow points towards the right and is therefore intended to show the direction of the rotation of the earth. In this case, the reader is supposed to make the connection between the arrow and a comment in the caption that we always are moving towards the east, as well as information in the running text about "the twist of the earth" (Sw. *jordens vridning*). The caption also says that we are either in or outside of the "shadow" (Sw. *skuggan*). How this shadow emerges is not made explicit, however, neither in writing nor in the illustration. Instead, the reader must imagine the sun and its position in relation to the earth. Furthermore, the reader is supposed to understand that the illustration is not supposed to depict two different globes, but instead that it is supposed to depict the earth at different points of time.

On the same page, there is also a toned text box. Text boxes are often used as a kind of "short facts" in pedagogical texts where the reader can expect to find key content. Here, however, the text box gives some "extra information". In this case the information deals with summer- and winter-time, which is used in large parts of the world, although this fact is not taken up in illustrations or in the running text.

7.1.3 Figurative Language

We have mentioned the use of an analogy between the axis (in itself a figurative description) of the earth and a stick through the globe. Here the authors have chosen to integrate the analogy in both the running text and the illustration. The choice to actually draw the analogical axis could be seen as a way of concretizing natural phenomena in science, to facilitate learning. In this case, in writing it is clearly expressed, through an explicite simile, that this is an analogy "we can think of […] as a stick", while in the illustration the depiction of the stick is integrated as a natural part of the earth.

It may be doubted whether the fact that the axis of the earth specified as a stick actually facilitates meaning-making related to the analogy. Instead, it is possible that the illustration makes the analogy more challenging, since it is unnecessarily concrete. Yet the fact that the analogy is explicitly explained in writing may be assumed to facilitate meaning-making for the student. The risk of coming to the wrong conclusion, that there is actually some kind of stick going through the globe, will then be diminished.

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[1]Among other things, an arrow can also depict a process, such as the transformation from one thing to another, or a temporal relationship between entities.

The conventionalized use of "axis"—a metaphor which is integrated in scientific discourse—is less clear in the text. There is in fact no axis, but instead the term is used *as if* there was an axis going from one pole to another. Yet another complication is that in Swedish the word axis is homonymous with the word for shoulder (Sw. *axel*). In a Swedish context, it is likely that children of this age are only familiar with the word *axel* as part of the body. This is an example of how subject-specific terminology with another use in everyday language can be a challenge for meaning-making around subject content. It is especially important to be aware of such challenges regarding students who learn in a second or foreign language.

7.1.4 Classroom Focus

From an educational point of view, a number of aspects in this text are worth devoting attention to in the classroom. Already the general structure of the layout and the graphical choices open up for things to discuss in the classroom, in ways that can function as a model for how to approach new texts. A starting point can be a mutual examination of illustrations and text elements on the pages. In relation to such a general overview, the teacher can point to the usefulness of benefiting from one's previous ideas and knowledge about text resources such as introductory paragraphs, headings, text boxes, illustrations, or captions. It may be worth noting that such textual resources can be used in similar ways across texts, but also that they can have different functions in different texts.

With regard to the various illustrations, a starting point can be to try to make out what they might depict, and how the illustrations can connect to the content in question, in this case "astronomy". Our close reading above pointed out a number of potential challenges regarding the interaction between different text resources. One way of dealing with that could be to read the caption together to find out which illustration the caption relates to, and how to arrive at that conclusion.

For all of the illustrations that are connected to the subject content, it is important to examine how the running text and captions are connected to the illustrations. One aspect to highlight can be what is expressed through the different resources and if they give the same (overlapping), or competing, or perhaps even contradictory, information. In all texts where figurative language is used (in this case the axis of the earth which is compared to a stick), it is worthwhile reasoning about how far the analogy reaches: which parts of the analogy are relevant and which are not?

7.2 Biology, Secondary School

Here we will examine another Swedish textbook, *Spektrum Biologi* (Fabricius et al. 2011) which is a fairly extensive book, dealing with areas like "Life on earth", "Bacteria and viruses", "Ethology", "Our environment", and "Drugs". We have examined

a couple of pages from the section "The human body". In a section on circulation in the human body we find the heading "The organs cooperate" (Sw. *Organen samarbetar*). At the left side of the book spread, the different organ systems are described. Here we take a closer look at the right side of the book spread, which is shown in Fig. 7.3.
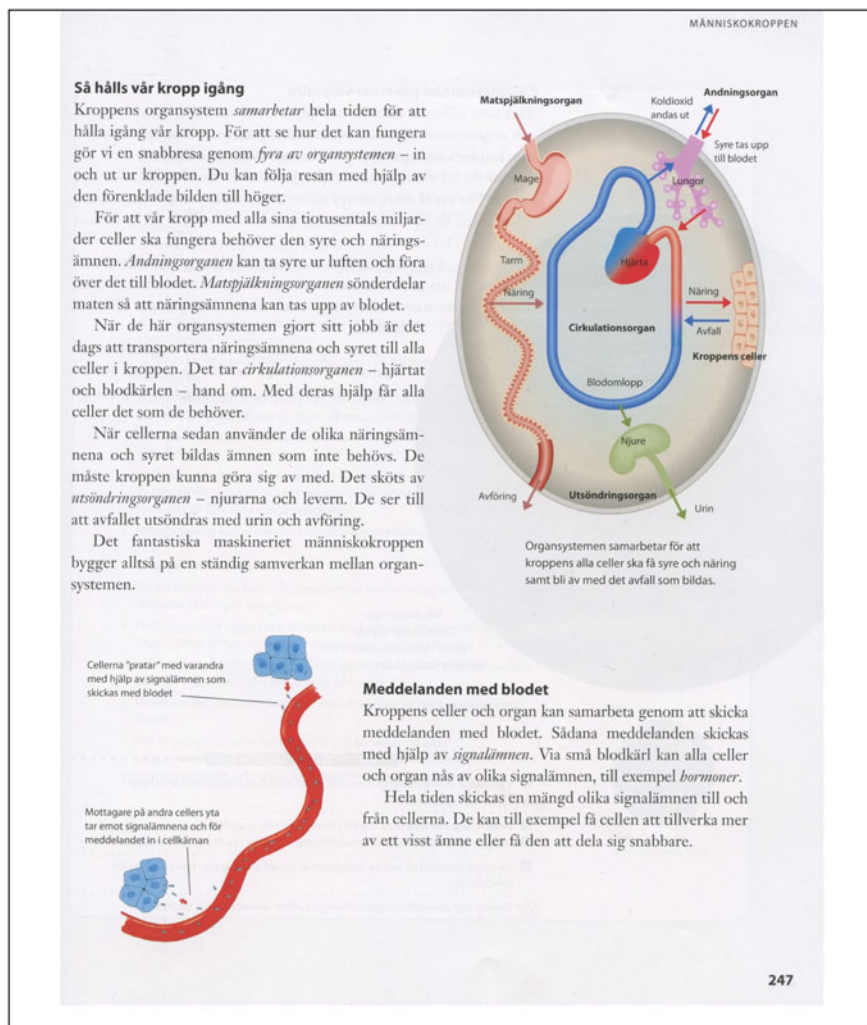
Fig. 7.3 The human body as a system. *Spektrum Biologi* (Fabricius et al. 2011, p. 247, with permission from Liber)

7.2.1 General Structure and Setting

Just like the bottom part of the page, the upper part, which dominates the page, consists of writing combined with an image. Both images on this page are prominent, the upper one perhaps because of its shape and the red color. To the left of this illustration, under the heading "This is how our body works" (Sw. *Så hålls vår kropp igång*) a quite long written text dealing with the ways in which the organic systems of the body "cooperate". This text is connected to a gray, egg-shaped illustration to the right. The image depicts four organic systems in quite an abstract fashion: digestion, perspiration, circulation, and secretion. The blood system is mainly depicted in blue, as opposed to the red color of the blood in the image at the bottom of the page. The gut and the intestines have, for some reason, the same color as the body cells.

At the lower part of the page, to the right, there is a short written text about "signal substances" under the heading "Messages with the blood" (Sw. *Meddelanden med blodet*). The wording of the heading and what it actually relates to is unclear. The illustration to the left of the text depicts a section of a blood vessel which looks like a red flood, with blue cells constituting some kind of end points.

What are the most prominent parts of the text on this page? Different emphasis is shown in different resources. In the upper part of the written text to the left, all of the different organic systems are italicized (*perspiration*, *circulation*, etc.). In the illustration to the right, on the other hand, the heart and blood circulation are centrally placed. Their prominence is further enhanced through the bright blue color. The other organs have been placed on the periphery of the "egg", in a somewhat paler pinkish-brown tone, green, and lilac, respectively. The fact that the blood system is prominent on this page is further enhanced by the vivid red color of the blood vessel at the lower part of the page.

We may presume that the author and the illustrator of this text want to enhance aspects that they perceive as especially prominent or important, within the different "systems". Naturally, not everything can be told or described, but the selection of information—in the form of facts in writing and illustrations—is not particularly easy to interpret in this text. Therefore, let us now go on to examine the interaction between different textual resources.

7.2.2 Interaction Between Text Resources

As mentioned previously, illustrations can be both facilitating or challenging for making sense of a text. In one sense, the "egg" in the upper right part of the page is concrete, since it depicts the interaction between *systems* in our body. But at the same time, the illustration is highly abstract, since it does not show what the organs look like, or their placement in relation to each other. Instead, the focus is on how the "systems cooperate".

The various systems have been placed side by side, with relative proportions which bear no resemblance to their real size. The small and the large intestines are placed at one side of the body, while the heart and the blood circulation system are shown as a more or less closed system in the middle of the illustration. Arrows placed between the blood circulation system and, for example, a kidney or intestine, reveal that there is some kind of connection or interchange between the parts. The body cells—where the size of each cell corresponds to approximately a fifth of a kidney—have been placed to the right in the illustration. Through their placement and heading style, they appear to be one organic system among the others.

From the right part of the illustration, it seems as if nutrition and secretion are connected, on the one hand, to the body cells, on the other hand, to the heart and blood circulation. At the same time, we find a digestive organ to the left, where something which gets into the intestines from the outside disappears as excrements down to the left. However, a kidney which is connected to the blood circulation through an arrow, and an arrow pointing towards the word "urine" (Sw. *urin*) can be found down to the right, though they do not seem to be connected to any kind of food or liquid intake. Eventually, the reader might realize that what is called the "secretion organ" (Sw. *utsöndringsorgan*) has something to do with the purification of the blood.

In the illustration, the word "blood circulation" (Sw. *blodomlopp*) is given, though in the text the word "blood vessel" (Sw. *blodkärl*) is used. Where the text mentions the circulation organ "heart–blood vessels", the illustration depicts the circulation organ "heart–blood circulation". Thus, here the text is in conflict with the *principle of congruence.*

Not only form, but color, too, carries information in the illustration. In this case, it can result in further challenges in the meaning-making process. The digestion organs to the left are depicted in a pinkish-brown color, just like the cells to the right. Here there is a congruence in the color coding, but does this mean that there is a connection between the digestion organs and the body cells? In line with the conventions of the particular subject area, it can be assumed that the red color depicts blood which is rich in oxygen, while blue depicts blood with a low level of oxygen.

The lungs have a pale lilac tone, while the kidney (why just one?) is light green. However, what does the gray shade in the background mean? Is it presumed to be a neutral background meant to separate the illustration from the white book page, or is it a depiction of "the body"? Thus, we can state here that even though color to some extent appears to carry meaning, this is not always the case.

On the whole, we may note that the relation between writing and image is complex in this text. Since the illustration in itself is quite abstract, the reader needs to have quite an advanced content knowledge to be able to interpret the illustration in relation to the fact-oriented information given in writing. The connection between the information in image and writing might be simple to make for anyone who is already familiar with the function of the organs of the body. However, for someone who comes across a text like this without previous knowledge, the information can appear to be incomplete, and to some extent even contradictory.

7.2.3   Figurative Language

This text contains an abundance of figurative language, not least metaphors, perhaps due to a presumption that the reader will be supported through connections to everyday experiences. However, such usage can also be potentially challenging. The text says that "the organs *cooperate*", and "[w]hen the digestive organ have *done their job*, it is time to *transport* the nutrition and oxygen to all body cells", which is "*taken care of* " by the circulation system". But what, for instance, does it mean that the digestive organs have "done their job"? And are the circulation organs waiting for a delivery from the digestive organ?

Further, the text says that the body is "a fantastic machinery" (Sw. *ett fantastiskt maskineri*). But a biological body is an organism governed by other principles than mechanical clocks or digital systems in a computer. In line with this, researchers in the area of brain research have left the analogy of the brain as a computer. Instead the brain is discussed in terms of a live organism which is dependent on a biological body which actively chooses and sorts information (Edelman 2006). Some adequate questions to pose in relation to this text are, for example: What are the gains of using the machine metaphor for the body, and what are the limitations? What possible misunderstandings can the machine metaphor give rise to?

At the bottom of the page, to the left, there is an illustration depicting how cells "talk" (Sw. *pratar*) to each other, a metaphor in line with the 1940s communicative model by Shannon and Weavers (1998). Here it is said that signal substances are *sent* to the other side, where there is a "*receiver* […] who *takes* the signal substances into nucleus of the cell". Here, the signal substances have become "messages" which are actively "taken care of" by a "receiver", who in turn "brings" the message into the nucleus of the cell (cf Pettersson et al. 2020, who showed how students used logistics metaphors to talk about the digestive system in a national test). The text humanizes the organs, thus depicting the body parts as having intentions. Such anthropomorphisms, as they are called, are known to create challenges for students, since the students sometimes mistakenly perceive natural phenomena as actually having intentions and feelings (for further discussions, see for instance Danielsson et al. 2018; Tibell and Rundgren 2010).

7.2.4   Values

In this text, no values are expressed explicitly. But are there any implicit values? In one sense, you can say that there is an underlying principle for organizing the subject content: a functionalistic model with cooperating entities possessing intentions.

Of course, it might be reasonable to use metaphors to present the function of our organs to the students. At the same time, such use can lead to other obstacles since the organs and their different parts are depicted as active objects. In one sense, such

a depiction weakens the value of the system model presented at the beginning of this section of the textbook.

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Chapter 8
Social Sciences

8.1 Geography

Geography is a school subject that embraces both natural sciences and social sciences, as well as the crossroads between the two. A variety of multimodal representations have long been used in geography textbooks, such as different kinds of maps of nation states and cities, weather conditions and natural resources, or production and trade. Today we can also find digital representations of dynamic changes, for example, the development of the earth or the changes of contemporary local landscapes.

It is interesting to note that since a majority of the population on earth today live in urban areas, the city itself has become an important part of what geography is about—such as questions concerning the planning of urban development and the need to foresee, for example, overflow damage to the city structure. In the following, we will give examples from one Spanish and one Singaporean textbook.

8.2 Geography—A Spanish City: Madrid

In the following we will present a short textbook description of Madrid as an autonomous region, based on a bookspread taken from *Tierra 5. Medio Natural, Social y Cultural* (Botines et al. 2006) (Fig. 8.1).

8.2.1 General Structure and Setting

This book spread describes "Madrid, an autonomous region" (Sp. *Madrid, una comunidad autónoma*) (1 in Fig. 8.1.). On the left page, the main text is presented in the left column (2, 3, 4). The authors describe Spain and its 17 autonomous regions according to the legislation from 1978 (2) and that Madrid gained its independence 1983 (3).
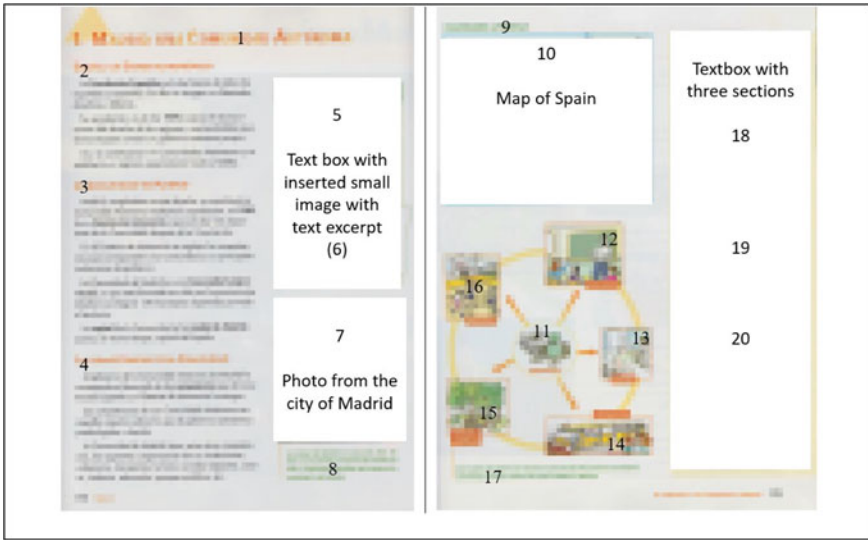
Fig. 8.1 Schematic image of Madrid, *Tierra 5* (Botines et al. 2006, pp. 178–179). Image changed for copyright reasons

The authors then describe different kinds of services available to the citizens, such as health care, schooling, and transports (4). In the right column, a green-shaded text box presents the legislative statutes for Madrid as an independent region (5). Underneath is a photo of houses and streets in central Madrid (7), with a caption explaining that this is a big city hosting most of the central institutions and official services (of the region as well as of the whole of Spain) (8).

On the right page, in the left column, we find two different illustrations. On top, there is a map of all the autonomous regions in Spain (10), and underneath a diagram with illustrated examples of public services financed by taxes (11): education (12), health care (13), public transport (14), communal parks (15), and sports arenas (16). A caption underneath the diagram says that a large part of the taxes go to public services (17). A yellow-shaded textbox to the right consists of a number of questions divided in three different areas: "Study the map", "Comment", and "Respond" (18–20). The first area is connected to the map (18), the second one to the image of the network of services (19), and the third one consists of questions, the answers to which can be found anywhere in the text (20).

8.2.2   Interaction Between Text Resources

In this textbook, we note a fairly high degree of proximity between different text resources. In the example used here, on the left page there is a written text about

autonomy, illustrated by an excerpt from the by-laws of the city (6). The description of Madrid is illustrated by a photo of the city (7), and the description of the city given in writing at the bottom of the page is connected to the diagram at the bottom of the subsequent page (11–17).

On the right page, the map (10) is linked to different questions under the heading "Observe the map" (Spa. *Observa el mapa*), explicitly requesting the student to use the map in different ways (18). These questions emphasize factual knowledge, such as the number of autonomous regions and their names. The diagram on the same page (11–17) is linked to questions about the commitments of the city, focusing on aspects such as the responsibility of the city (19). The questions on the bottom of the page (20) concern facts given somewhere in the book spread.

8.2.3 Classroom Focus: To Create a Narrative

In this example, it seems necessary for the teacher to create a narrative in order to explain the significance of the different factual pieces of information. Why, for example, was 1983 an important year for the city of Madrid, and what were the consequences for the city, the region, and the country? In doing this, the teacher can link the narrative to the illustrations on the right-hand page, for example to clarify public services (with the aid of the diagram at the bottom of the page), and also to compare Madrid as a region with other regions in the country (the upper map).

In other words, the multimodal resources in this book can be linked together by the teacher to present an overarching story about the historical and social significance of the information.

In the next example, which is from Singapore, we may note a narrative structure in the textbook, which can result in a more precise engagement of (possible future) actions by the student. Here the information is framed in environmental terms, not only in terms of political or administrative functions, and the role of the teacher might in this case be to support discussions among students, and to discuss different solutions to complex problems.

8.3 Geography—Urban Living: Singapore

The following example is from the textbook *All About Geography, Urban Living* (Goh et al. 2015), where we will focus on the example "Floods. How can cities prepare for flood?".

8.3.1 General Structure and Setting

We here begin our analysis with a book spread about "River floods" and "Flash floods" (Fig. 8.2). At the top of the left page we find a drawing—a cross-section of a river channel, and at the bottom two different aerial photos of the Mississippi River near Memphis in normal conditions (to the left) and during the flood in 2011.

The top of the right page shows a photo taken from the air during the flood in Brisbane, 2011, and at the bottom a flash flood in Kuala Lumpur, 2012. In the right margin there is an explanation of "Geographical Concepts—Scale" such as large-scale floods (Brisbane in 2011) and small-scale floods (the flash flood in Orchard Road, Singapore, 2010). Here there is also a "Bookmark" with a link to a video film about "the experience of people during a flash flood".

Most of the space is dominated by visual illustrations, which underline severe effects of flooding throughout the world. These pages also underline that a flood can happen suddenly, and for different reasons.

On the following pages there are descriptions of different causes of floods, such as rainfall (intensity, duration, frequency), snowmelt, storm surge, and tsunami, height of land above or below sea level and proximity to water bodies, or the failure of man-made structures (such as dams, levees, and floodwalls, or an under-dimensioned channel capacity). Here the reader can also find out how floods affect people living in cities, such as the spread of diseases and loss of life, homelessness, disruption of
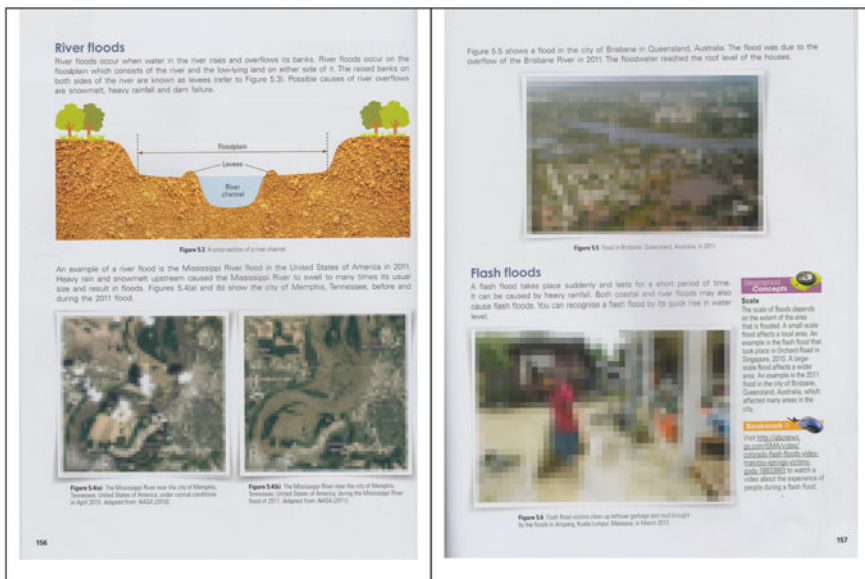
Fig. 8.2 River floods and Flash floods. *All About Geography, Urban Living* (Goh, Yu & M.C. 2015, pp. 156–157, Reproduced by permission of Hodder Education, photographs blurred for copyright reasons)

Fig. 8.3 How should cities prepare for floods? *All About Geography, Urban Living* (Goh et al. 2015, pp. 180–181, Reproduced by permission of Hodder Education, photographs blurred for copyright reasons)

clean water supply, damage to transport infrastructure, or disruption of energy supply. This leads to the question how cities then should prepare for floods (Fig. 8.3).

At the top of the left page in Fig. 8.3 we find a heading and a list of what "you will learn". Underneath we find two photos, one showing a flash flood at Lucky Plaza in Singapore in 2010, and the other showing people placing sandbags along a road in Bangkok in 2011. On the right page different "mitigation measures" are presented such as "Regulation", here exemplified by "Zoning". On the following pages we also find other examples such as "Elevated properties" and "Investment in infrastructure", "Forecasting and warning system", and "Evacuation drills".

8.3.2 Interaction Between Text Resources

In our first example from *Urban Living* (pp. 156–157, Fig. 8.2), the relations between visual illustrations and written text are close and congruent. The illustrations are the predominant resource, and they can function as a starting point for discussions. Central here is the phenomenon "floods", including different descriptions of "scales". However, through the sketch of the cross-section of a river channel, there is also an opportunity to start a discussion about causes (which can be followed up and taken deeper later in the book).

Our second example (pp. 180–181, Fig. 8.3) is focused more on the socio-economic impact and the concern for communities that are affected by natural hazards. The central theme here is preparations to handle floods of different kinds, with a stronger emphasis on explanatory and descriptive texts. The teacher can of course, if necessary, clarify how the information, the descriptions, and explanations on the following page can be used to answer the questions on the upper left page (p. 180).

8.4   Social Sciences as a Multimodal Challenge

We have focused here on two kinds of representations of geography: one more traditional textbook focusing on political and administrative legislations, and one more modern focusing on overarching themes, which also has references to sources outside the book. However, by using these examples, we would not want say that the first is "wrong" and the second one is "right". What we want to underpin here is that the different resources present different affordances for the teachers and the students, as well as different opportunities to use the information: different resources give different opportunities for teaching and learning. In both cases, it is up to the teacher to frame the information so that the pupils will have an opportunity for meaningful learning. Therefore, it is not enough to (only) explain what the words as such mean; these words must also be framed in relation to other kinds of multimodal representations.

8.5   History, Secondary School—A Matter of Values

In our model for reading texts with a focus on multimodal and educational aspects (Table 4.1, Sect. 4.5), we differentiate between the overall structure and setting of the text, the relation between different parts of the text, as well as the role of figurative language and values. We have also stated that you do not have to use all the categories every time you analyze a specific text. In our analysis of history textbooks, we would like to emphasize the specific role of values, looking at two textbooks about the war in Vietnam: the Swedish book *Utkik, Historia, Grade 7–9* (in English "Lookout, History—History Grade 7–9", Nilsson et al. 2013) and *All About History. The Making of the Contemporary World Order, 1870s–1991,* Cheong and Huang 2015) from Singapore (Fig. 8.4 and 8.5).

Fig. 8.4 The Vietnam War, *Utkik Historia* (Nilsson et al. 2013, pp. 270–271, with permission from Gleerups)
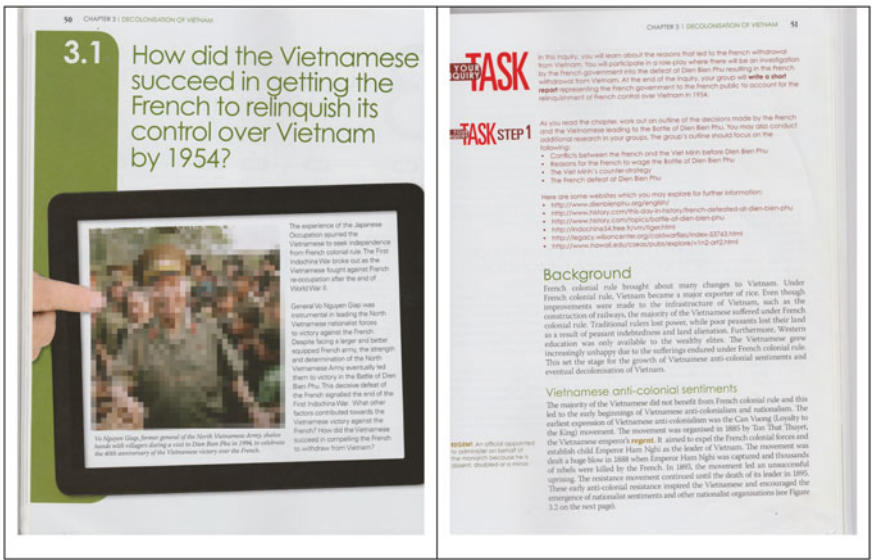

Fig. 8.5 How did the Vietnamese succeed in getting the French to relinquish its control over Vietnam by 1954?, *All About History* (Cheong and Huang 2014, pp. 50–51, Reproduced by permission of Hodder Education, photograph blurred for copyright reasons)

8.5.1 General Structure and Setting

At a general level, one can immediately notice that the Singaporean book empha-sizes "the making of nation states", whilst the Swedish book more vaguely focuses on "the time after the war". A closer look reveals that the heading in the Swedish book announces "Vietnam", and the subtitles focus on "History and statistics" and "Killed *Americans* in Vietnam" (our emphasis) respectively. In the Singaporean book, the heading talks about "Decolonisation of Vietnam", and the subtitles are phrased as follows: "How did the *Vietnamese* succeed in getting the French to relinquish its control over Vietnam by 1954?" (our emphasis): "To what extent was the estab-lishment of an independent Vietnam in 1976 more a result of internal rather than external factors"? At the end we find the subtitle "Think like a historian: Causation: categorising factors" and "Practising history: Developing and concluding a causal argument".

Both the thematic orientation and the sequencing of information are obviously differently designed in these two textbooks. We can also notice that the Swedish book introduces the term "domino theory" (i.e. in the political language of those days in the West—if one country falls into the hands of the communists, others will follow), whilst the Singaporean book instead emphasizes the question of "anti-colonialism".

If we now continue with the question of what different semiotic resources offer, we will find the following caption in the Swedish textbook: "The Vietnam War", although most of this part talks about the different wars in Southeast Asia. This is followed by subheadings and short, descriptive texts. The map on the left page (Fig. 8.4, at the place of "the given" according to Kress and van Leuwen 2006) shows where in the world we can find Vietnam, whilst the information on the right page ("the new" information) shows American soldiers as active agents (those who do things), albeit with some negative hints.

The Singaporean textbook shows on its left page General Giap (at the place of "the given"), and on the right page (the "new" information) a subheading about "Vietnamese anti-colonial sentiments" (Fig. 8.5). In this book, the world map is not that necessary, since those who read the book probably know very well where in the world they are situated. Instead, the Vietnamese victory is the given starting point, and the Vietnamese people are seen as the active agent. And in addition, under the subheading "Background", we find different "Tasks" for the reader to solve.

8.5.2 Interaction Between Text Resources

Regarding the interaction between text resources we may notice interesting differ-ences. In the Swedish book, the map is linked to the escalating war in Southeast Asia. It starts with the war with "the French" and the battle at Dien Bien Phu, followed by the war with "the US". The photo on the right page (Fig. 8.4) is talked about in terms of "severe sufferings".

The text book from Singapore emphasizes to a larger degree the war against the French colonial power. On the left (Fig. 8.5) we find, as mentioned, General Giap and the Battle of Dien Bien Phu. On the right side, we find different pieces of information: tasks, websites (and later also "sources", for example with quotations from books and speeches) and a text that describes the background to the anti-colonial movement. The war with the US comes much later in the book.

In this book, we also find a thematic thread from victories and anti-colonialism to the building of new nation states. Even though the Swedish book also talks about "The liberation of the colonies" (pp. 268–269, not shown in the figures), it is with a very distant voice: "The so-called de-colonization started in Asia at the end of the 1940's and spread to Africa 10 years later". Furthermore, the perspective of colonization is not directly linked to what then follows about the Vietnamese war.

8.5.3 Figurative Language and Values

We do not find a lot of explicit figurative language in these texts. However, the Swedish book refers to the "domino theory" or "crushing defeat", and in the Singaporean book expressions like "power vacuum" and "puppet government" are used. On the other hand, the values that are brought to the fore are quite obvious, even though they are not explicitly stated. For example, the Swedish book emphasizes that out of 2.5 million people that were killed during the Vietnam war, 58,000 were *Americans*, and on the following page we find a map showing how many Americans were killed in different provinces. In the book from Singapore it is instead the suffering of the *Vietnamese people* that is emphasized (during both the French and the American occupation)—when peasants lost their land and higher education was accessible only for students from privileged groups.

Obviously, the socio-political place in the world frames perspectives and the selection of facts—where the western hemisphere gradually seems to lose its control over different parts of the world, and where the eastern hemisphere grows in importance and self-government, and self-esteem. A way for teachers (in both countries) to highlight these aspects could be to compare multimodal representations, descriptions and explanations of the "same" historical situation from different points of view, as can be found in different learning resources—which also will reveal the underlying (often immanent and "natural") value statements.

8.5.4 Representing History

The discussed differences between the two books can of course also be found in other parts in each of them. For example, the captions on the following pages in the Swedish book highlight such themes as "Humans on the move", "The end of the

Cold War" and "Towards a global world", whilst the Singaporean book focuses on "decolonisation" and "the construction of nation states" in Southeast Asia.

However, the fact that different textbooks have different perspectives does not need to be problematic. On the contrary, in a field like history, one can discuss different perspectives, different values, and different ways of representing the historical knowledge—and by doing so, deepen the historical understanding (cf. Insulander et al. 2016; Wheatly 2001).

Yet another aspect we would like to emphasize here is the question of *activity linking* (Selander 2018). In the book from Singapore, we find clear links between the kind of activities the pupils are supposed to perform, and the kind of information, sources, websites, etc. that can be found in the text. In other words, the text is modeled on how information is to be understood and used by the reader. The pupils are also encouraged to work collaboratively, to think like a historian, and it is clear which (in this case) four questions the pupils are supposed to focus on. The Swedish book is much more superficial and vague. One example: "From your geography studies, you are used to maps that show different places. In this case, the map is used to describe a certain kind of event. Can you think of anything else that you can show with the help of maps"? Hence, instead of a question that helps the pupils to deepen their understanding of historical processes and events, they are here suddenly moved away from the topic to something totally different.

8.6   Religion, Elementary School

In the Scandinavian countries the subject Religion has its origin in the subject Christianity. Today, this subject is supposed to be a guide to the stories, holy places, rituals, and symbols of different religions, and furthermore, to be an arena where ethical questions can be discussed. It might seem inevitable that in description of religions from a Western perspective there is a central, symbolic space—in Lotman's (1990) terms, a semiosphere[1]—in this case with Christianity as the natural point of departure. This can be explained by quite divergent things, such as the dominance of Christianity since the Middle Ages, or the historical roots of the school subject, but also the political discussion. Here we will examine how different religions are introduced in different ways in a Swedish textbook. The differences concern things like what facts to present and the different illustrations chosen with regard to the religions and those who practice the religion in question. We will return to these questions under "Values" (Sect. 8.6.4).

In the following, we will focus on the sections "Visiting a Christian home" (Sw. *På besök i ett kristet hem*) and "Visiting a Muslim home" (Sw. *På besök i ett muslimskt hem;* Figs. 8.6 and 8.7) in the textbook *Upptäck Religion* (Eng. *Discover religion*) (Ring and Sandin 2008), produced for elementary school years 4–6.

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[1]Lotman (1990) describes the "semiosphere" as symbolic spaces that express aspects such as centre and periphery, demarcations, and power relations.

Fig. 8.6 Visiting a Christian home. *Upptäck Religion* (Ring and Sandin 2008, pp. 12–13, with permission from Liber)

Fig. 8.7 Visiting a Moslem home. *Upptäck Religion* (Ring and Sandin 2008, pp. 72–73, with permission from Liber)

This textbook is also produced in an online version, with the same layout as the printed version.[2] The online version supplements the printed version through resources such as Internet links, the possibility to add notes to the text, or to have an electronic voice reading sections of the text. When you click a button for "extra resources", a page with a video film is shown. Apart from the film, the online

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[2]The images in this section are screen shots taken from the online version of the textbook.

version contains links to other electronic resources connected to the textbook. We will comment briefly on the content of the video films in relation to the different sections examined.

8.6.1 General Structure and Setting

The general structure is similar in both chapters, but we also note differences in the ways that a number of phenomena are presented. In both sections, the central written text is placed in the middle of the book spread, and illustrations and text boxes are placed around this written text. In the presentation of Christianity, we find a book of prayers in the upper left corner. Under the book, the Lord's Prayer, "Our Father"—in a modernized version—is given in a blue-shaded text box. A large image to the right at the bottom of the left page shows a family saying grace before eating. Below that image, a yellow-toned text box explains words like "prayer" (Sw. *bön*) and "hallowed" (Sw. *helgat*). The text box has a heading "Word list" (Sw. *ordlista*) placed vertically to the left. Text boxes containing explanations of words are used throughout the textbook. Also, all the words explained in text boxes are italicized in the running text and the explanations are bolded.

The right page contains two headings: "The cross is an important symbol", and "Baptismal Candle" (Sw. *dopljus*). The cross is illustrated through hands clasped in prayer, holding a cross above a book (presumably the Bible). The baptismal candle is illustrated by two newly lit candles. Below that photo are two more explanations: "symbol" and "rise from the dead" (Sw. *uppstå*). In the rightmost lower corner is a yellow-toned text box "Did you know…" (Sw. *Visste du att…*), which explains the word "amen". Two of the illustrations depict things (a book and a candle), while the others depict people in some kind of action (praying).

In the corresponding section on Islam we find the heading "When the sun sets the fast is broken" (Sw. *när solen går ner bryts fastan*) on the left page of the book spread. The right page contains the headings "Then it is time to pray" (Sw. *Sedan är det dags för bön*) and "During Ramadan you are supposed to be particularly nice" (Sw. *Under ramadan ska man vara extra snäll*). The left page contains two illustrations, a photo of dates in a box with a hand taking one date, and a photo of "Muslim food" (Sw. *muslimsk mat*) with a text about halal in a blue-toned text box. On the right page, we find a photo showing a big table, and a small girl laying the table. Another photo depicts different kinds of prayer compasses. Here a text says "You can even use a mobile phone to show the direction to Mecca". At the bottom of the page, to the right, there is a text box toned in yellow: "What do you think?" (Sw. *Vad tycker du?*) with the text: "During Ramadan you are supposed to avoid having disputes with others. Among Christians it is common to try to be especially kind at Christmas. Is it a good thing that you are sometimes forced to be kind?".

In the online version of the textbook three short video films are connected to the sections above. In the section about Christianity the film "Talking to God" is introduced through a short sequence from a ceremony in a Swedish church. After

that a longer sequence follows, where a woman explains her relation to praying. In the section about Islam, there are two films, "Religion at home" (connected to the left page in the book spread) and Ramadan (which is connected to the right page). In both films, informative sequences are mixed with short sequences with children's comments, and sequences showing people praying or reading the Quran.

8.6.2 Interaction Between Text Resources

Different semiotic modes interact in the section about Christianity. One theme is prayer: the main text on the left page deals with prayer, illustrated by a book of prayers and the text of the Lord's Prayer. The main image depicts a family praying at the table. Another theme is the cross (eternal life), sometimes used in prayer (the image to the right on top of the page). A third theme is the baptism (being christened) and a baptismal candle. The text box "Did you know…" deals with "amen" the final word in a prayer. Five central concepts are explained here: prayer, hallowed, symbol, rise, and amen.

In the Muslim home, fasting is a central theme. The text says that you break the fast with a date, which is illustrated by a hand taking a date. At the bottom of the page "halal"—in this case admissible food—is illustrated by plastic bags with chicken legs in a deep freezer. Another theme is prayer, illustrated by a prayer compass, and a third theme is the fact that you are supposed to be kind during Ramadan, which is compared to a Christian rule for Christmas. Three words are explained: fasting, prophet, and role model. There is no "Did you know…" text box in this section, but instead the reader is invited to ponder over calls for kindness.

8.6.3 Figurative Language

In the Christian home, the candle is a symbol of the transition from darkness to light, which in this case means the transition from not being Christian to becoming a Christian. The word 'symbol' is explained as something which is "used as a sign for something", and it is exemplified by a heart, which is "as symbol of love, to care about".

The text about Islam states that you cannot eat while the sun is up, and that you break the fast when the sun sets, then eating a couple of dates and drinking a few sips of water. The text also says that the reason why this is done is because Muhammad did so, and that many Muslims want to do "what he did". In what sense the position of the sun affects the fasting remains unexplained.

8.6.4   Values

If we once again use Lotman's (1990) concept of "semiosphere", we can clearly see the different perspectives that are used. In the Christian home we are invited to "an ordinary evening" (Sw. *en vanlig vardagskväll*) where the family say grace before having dinner. Here, the center is a (Swedish?) middle-class family, acting in a shared religious ritual (praying).

In the Muslim home, on the other hand, we are invited to a family celebrating Ramadan. In this case we (as viewers and readers) are not placed in the center, but look out from a distance. The text deals with fasting, and then prayer. No human beings are engaged in shared activities, instead the images depict individual activities: a hand taking a date, two arms lifting a packet of chicken from a freezer, and the young girl who is helping someone to lay a table.

In the Christian home, the different actions connected to a Christian's relation to God are described as a strong feeling of love. In the Muslim home, only the prayer ritual is described, and instead of love, the text focuses on the fact that you are supposed to be kind and helpful. It is worth pondering over how a Western reader would have perceived a description of "an ordinary day" in the Muslim home, with explanations of the relation to God, including a heart as a symbol for love, while the Christian home was described in terms of observable rituals during Christmas celebrations, and the expected kindness. Here we probably would not need any close analysis to experience where the center and periphery of the semiosphere are located.

In the films that are available in the digital version of the textbook, we can hear the voices of Muslim children. However, since the films have been created in an English-speaking country, Swedish children are reading translations from the original, which creates a distance. The title of the film is "Religion at home" with a subheading "Many girls pray and read the Quran at home". The film shows two sisters praying at home and how their mother teaches them about the Quran (while it is said that boys more frequently pray in the mosque among the other men, and that they go to Quran classes).

A couple of other things are worth noting in the films, for instance that the speaker says that the girls are learning Arabic "to be able to read the Quran". But is not the language a means of communicating at home or with relatives? In the film it is not clear whether the girls speak another language than Arabic at home (there is a Swedish voice-over when the children in the film talk during interviews), or if the film refers to the fact that the girls are learning the Arabic written language and classic Arabic, which differ from the spoken dialects. Of course, it might be asking too much if the film were to explain how the language of the Quran differs from spoken dialects, but the comment about learning the language contributes to maintaining a world of "us" and "them". That perspective is especially noticeable from a comment about the Arabic written language: "before you have learnt the language it looks really tricky". Does that mean that, for instance, the Swedish orthography looks less tricky for anyone not used to it? Also, "to know a language" (regardless of language) does

not imply that it is easy to read the language, even though language knowledge is a prerequisite for reading with understanding.

The film titled "Ramadan" has (just as in the printed version) a sub-heading "During Ramadan you must not eat or drink until the sun has set". In the film a boy tells us how hungry and tired he is during Ramadan, while a girl comments on the fact that you then will experience how it can feel when you are poor (and that it is easier when Ramadan falls during the winter months, when the sun is up for a shorter time than during summer). The film also shows that in the children's school, there are two rooms where the Muslim children can pray.

As mentioned, the film connected to the section about Christianity is introduced with a short sequence from a ceremony in a Swedish church. The speaker voice says that in the Swedish church there are many different kinds of sermons, and that this particular sermon includes a lot of music. This is followed by a longer sequence in which a Swedish woman tells the viewer about her relation to prayer. She says that the prayer can be different depending on whether she is on her own or if she is praying in a larger context, and she also says that the actual location is of no importance. Instead she can pray wherever she can feel the presence of God and the deeds of God, for example by the sea. As a whole, Christianity appears to be a flexible religion.

If we compare the images we get through the video films, we note some clear features. For instance, Islam appears to be more distant for a Swedish reader than Christianity. The films about Islam haven't been made in a Swedish context; instead films from an English-speaking context have been used, in which children's voices are replaced with Swedish voices reading a translation. Also, these films focus on what is "different": the Arabic orthography "looks really tricky", and you learn the language to be able to read the Quran. The children in the films comment on how hard it can be during Ramadan, for instance when seeing "everyone else" eating.

The video film with the Christian woman was made in Sweden and we get a personal image of her belief, which is a flexible way of practicing your religion. Does that mean that a Muslim cannot be different in different contexts, or that you cannot speak to your God whenever you experience the presence of God? How would the relation to "the unfamiliar" have been affected if Swedish Muslims had been focused on, or if the film had examined why you are supposed to pray at specific hours (not to risk forgetting your belief in God), or the importance of always remembering that you are lucky to have food every day?

The fact that children of the same age as the supposed viewer are involved in the films about Islam could possibly diminish the distance between "us" and "them". At the same time, the Muslim children in the films do not live in a Swedish context, which might appear misleading. People practicing Islam, as well as Christians, live in all parts of the world and in many cultures. Is there any specific reason why the Muslim children in these films live outside of Sweden?

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Chapter 9
Language

9.1 English as a Foreign Language, Elementary School

In Sweden, English is a language with high status, and digitization in particular has made English easily available so that many children learn English outside of school, what is called 'extramural English' (Sundqvist and Sylvén 2016), through commercials, music, and different digital media, including online games, YouTube clips, etc. Furthermore, Sweden has a long tradition of subtitling films rather than dubbing, apart from animated cartoons for the youngest, which are often released in two versions, one dubbed and one subtitled. Thus, Swedish children even in early grades could be expected to have learned English through various out-of-school literacy practices (cf. Street 2003).

In the Swedish school system, English is a compulsory subject from grade 3, elementary school (children aged around 9) though schools can choose to introduce English at any time during preschool class or in elementary school up to grade 3.

In the following, we analyze a textbook in English for Swedish elementary school, grade 4 (students around 10 years of age). The same textbook has been analyzed in an unpublished work by Maria Nilsson (2015), who concludes that this text—like many other textbooks in English—to a great extent consists of "atypical" genres in a kind of "school English". Some of the findings from that analysis are used here as well.

In our analysis we will look closely at two spreads from the textbook *Happy! Textbook Year 4* (Sutcliffe et al. 2009).[1]

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[1]Exercises focusing on various aspects of English grammar are provided in a separate exercise book.

9.1.1 General Structure and Setting

At the start of the book, the reader is presented to the Best family, living in Manchester, England. In the first chapter of the book, the readers learn some basic facts about Adam and Kate Best who are brother and sister: their favorite sport, food, and color, etc.

The book is structured in a number of chapters dealing with different content with the aim of letting students practice various aspects of the English language, such as grammatical constructions or word knowledge. The texts presented in the book spreads shown in Figs. 9.1 and 9.2 are supposed to give the students opportunities to practice constructions like "are/is wearing" and plural forms of regular nouns (Fancy Dress Day, Fig. 9.1). The reader is not provided with information about what structures or content areas the student is supposed to practice in the respective section. Instead this is implicit. Most book spreads have the same overall structure, with a heading given in a red text box, and with writing combined with—usually drawn—illustrations. Each spread provides the reader with a glossary with Swedish translations of a number of words, given in text boxes separated by dotted lines. For each section, there is an equivalent section in an exercise book.

What is particularly striking in this textbook is the ample use of dialogues, regardless of content. The text in Fig. 9.1 is an example of this. This is a kind of dialogue that would hardly be heard in natural conversation; instead it gives some kind of description of the illustration filling the top of the book spread. Thus, instead of
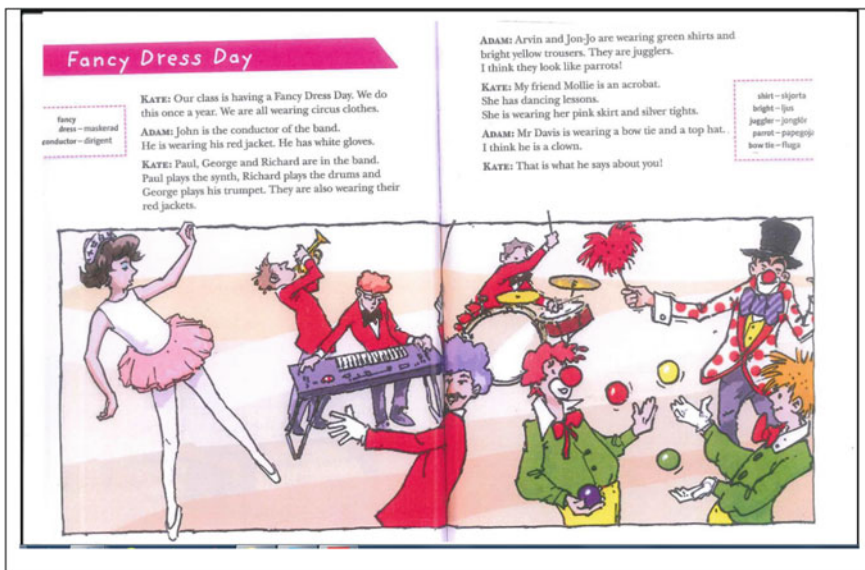
Fig. 9.1 Fancy Dress Day, *Happy Grade 4* (Sutcliffe et al. 2009, pp. 34–35, with permission from Gleerups)

achieving the goals regarding dialogues indicated in the curriculum documents, the use of dialogues seems to be a way of structuring read-aloud activities in the classroom, where students can be asked to read different parts of the text (in this case Kate and Adam). This is a recurrent pattern right from the start of the book, where Adam and Kate have a dialogue presenting themselves (presumably to the intended reader).

9.1.2 Interaction Between Text Resources

As was mentioned above, each section provides the reader with a glossary. The words in the text boxes are presented in the same order as they appear in the text, which makes the words relatively easy to find. The illustrations given in each section are clearly connected to the writing on the same page, and they can therefore support a reader who is unfamiliar with the content of the text. However, the illustration of the rainbow shown in Fig. 9.2 can hardly support a reader who is unfamiliar with the physics of light. In writing, information is given about the ways in which different colors bend. Here the rainbow with a pot of gold gives no support for the reader who wants to know more about this phenomenon. This book spread is one of few examples with a content that is clearly connected to other subject areas—in this case science. Thus, here the students have an opportunity to actually learn more about light spectra at the same time as they practice their English in the area of science.

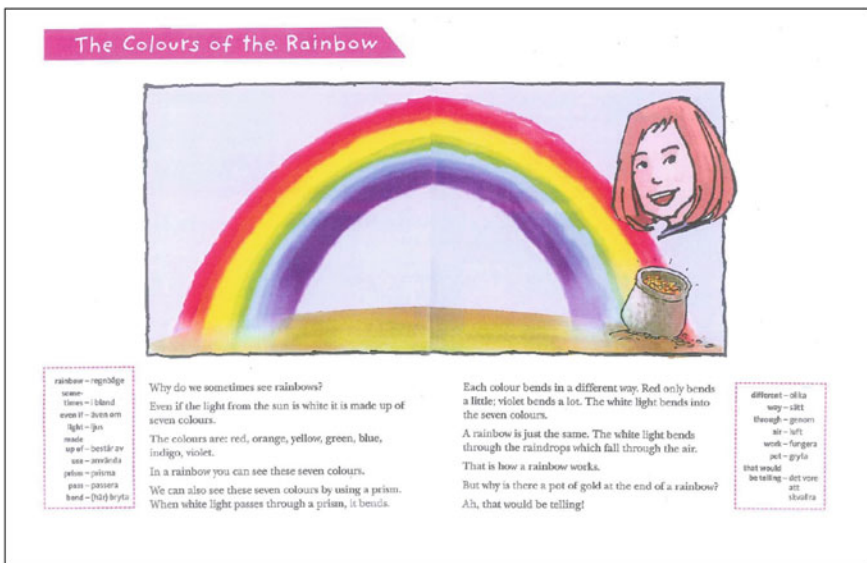**Fig. 9.2** The colors of the Rainbow, *Happy Grade 4* (Sutcliffe et al. 2009, pp. 26–27, with permission from Gleerups)

Yet it is obvious that such a benefit is not the intention of the author, not least since it presents the golden pot at the bottom of the rainbow as it is in fact for real.

9.1.3 Figurative Language

There is no figurative language in the sections we use as examples of this textbook, apart from Adam's comments that the jugglers look like parrots and Kate's comment implying that Adam is "a clown". Given the difficulties language learners can have with figurative language, the lack of such expressions is more or less expected in a basic language textbook like this.

9.1.4 Values

The textbook as a whole reveals a number of implicit values. Examples are the traditional roles that boys and girls are given in the illustration in the text about the Fancy Dress Day. The illustration takes up the description of the only girl in the text as having dancing lessons and wearing a pink skirt and silver tights. In the illustration she poses in ballet fashion. In writing she is also said to be an acrobat, but that is not shown in the illustration. The boys, on the other hand, form a band and in the illustration they are remarkably active in their playing.

In other parts of the book, English people and their habits are described in quite stereotypical ways. In one section it is said that "In England many people have a full English breakfast", and that "Many people have a special Sunday lunch of roast beef, Yorkshire pudding", etc.

Less traditional is the description of the elderly in an overall section called "Friends". Here a band is presented, consisting of residents in a retirement home. They all seem to be quite healthy and active, for instance forming a band and being interested in motorbikes and the like.

9.2 English, Secondary School

Our second example regarding languages is taken from the Singaporean textbook *All About English* (Doyle et al. 2011). Thus, this example does not concern foreign language learning, although in Singapore, English is one of four official languages (the others are Mandarin, Tamil, and Malay). Therefore, Singaporean students—as well as students from other linguistic backgrounds—can be expected to not to have English as their mothertongue or strongest language. The textbook has four main sections: Listening and viewing, Reading and viewing, Speaking and representing, and Writing and representing, thus giving attention to meaning-making from reading
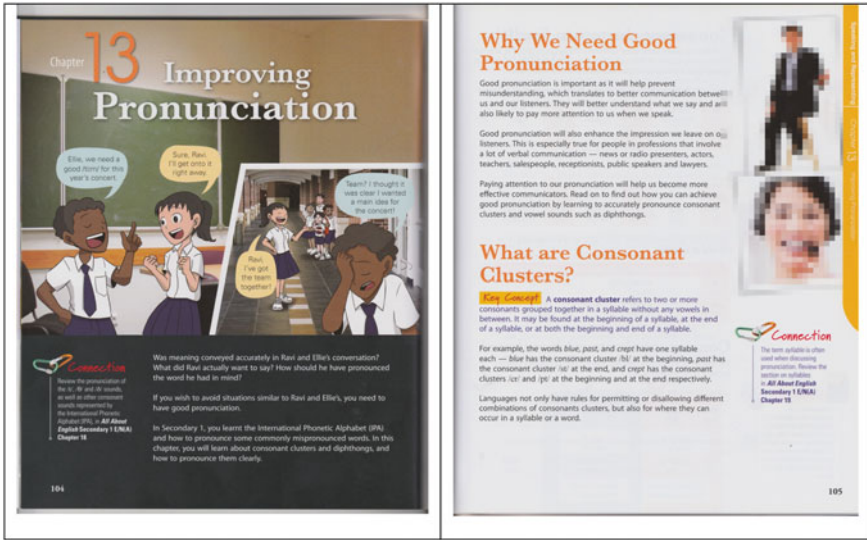
Fig. 9.3 Improving pronunciation, *All About English*, secondary school (Koh et al. 2011, pp. 104–105, Reproduced by permission of Hodder Education, photographs blurred for copyright reasons)

and creating texts, both paper-based and digital, including films, etc. Each section consists of a number of chapters. In the following, we will have a closer look at one chapter in the section on Speaking and representing: "Improving pronunciation". Figure 9.3 shows the first two pages of the chapter. In the following, we concentrate mainly on the general structure and values. However, since multimodality is the focus of our book, it is of interest to take a brief look at how multimodality as a theme connected to work with text is handled in this textbook. The textbook—just like the Singaporean textbook in science that was used as an example to present our model in Sect. 4.5—is in itself complex regarding the use of different visual representations (see Figs. 9.3 and 9.4). The layout is largely built on a variety of visual resources, such as photographs, text boxes, tables, and color, and recurring symbols indicate connections with, for instance, preceding chapters or textbooks or aspects of the content that the students are supposed to pay special attention to. But how is multimodality as a phenomenon treated in the text? First, the chapters dealing with speaking and writing are denoted "Speaking and *representing*" and "Writing and *representing*" (our italics) respectively, implying a possible multimodal focus on communication. However, a closer look at these chapters reveal a limited focus on other resources than speech or writing. Some comments are given on layout and the use of images in the chapter on writing, though mainly in a very general sense, for instance that photographs can be included in a travel report. In a section on how to write informative brochures some comments on layout are given, though commonly quite vaguely, like "Choose a layout and organization that is suitable for the information you are giving and that will help to achieve your purpose". However,
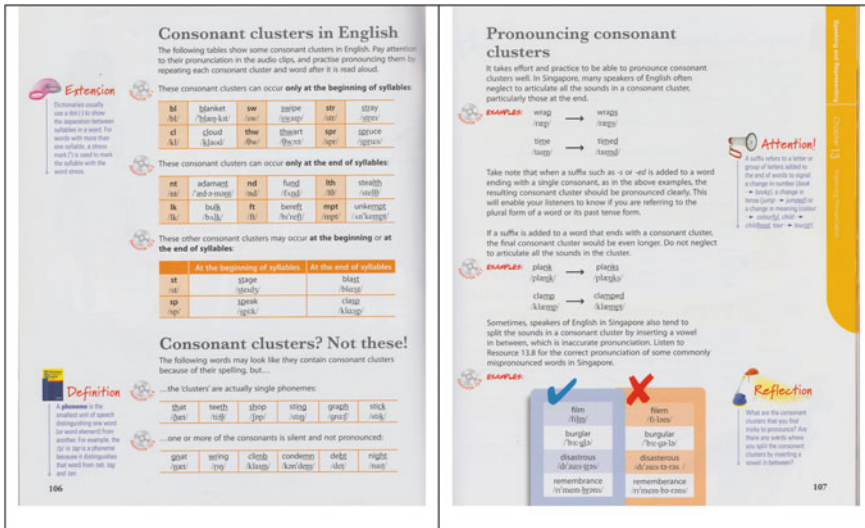
Fig. 9.4 Improving pronunciation, *All About English*, secondary school (Koh et al. 2011, pp. 106–107, Reproduced by permission of Hodder Education)

little is said about *how* to do that. Now let us take a closer look at one chapter in the section Speaking and Representing, namely Improving Pronunciation (Figs. 9.3 and 9.4).

9.2.1   General Structure

We can note that the chapter starts off by giving an everyday example of what is viewed as a common mispronunciation in the vernacular Singaporean variety of English: a boy, Ravi, pronounces "theme" as "team" which results in a misunderstanding. The reader is told that you need to have "good pronunciation" to avoid similar situations. Then the reader is given an introduction to pronunciation together with more arguments for the importance of correct pronunciation. The rest of the chapter has a thematic structure, first dealing with consonant clusters and then vowel sounds, including diphthongs. In these sections the reader is given overviews of the English sounds, combined with instructions about how to pronounce the sounds correctly, with examples of common mispronunciations to avoid. The International Phonetic Alphabet (IPA) is used, and symbols indicate that audio files are available through digital resources (in this case, a compact disc).

The text includes a variety of textual resources. Apart from printed words in headings, text-box-like sections labeled "Connection", and running text, the first introductory book spread contains a comic strip with school children and photographs of professionals working in areas where good pronunciation is important. In the

succeeding pages, tables are commonly used to present English words with similar spelling or pronunciation in systematic ways, presumably based on sounds where the pronunciation in vernacular Singaporean English differs from Standard English. Throughout the book, symbolic images like a shackle (p. 105) for connections to another book in the same series or an image of a dictionary for definitions (p. 106).

Just as in the example from the Singaporean science textbook that we used to introduce our analytical model, the starting point of the chapter is an everyday problem followed by a movement towards systematic descriptions similar to the ones used in the discipline, in this case linguistics. In both of these textbooks, the movement towards the discipline concerns both content and text resources used: the comic strip and photos of people using spoken language on the first two pages, followed by tables containing subject-specific symbols from the IPA, with terminology such as 'syllables', 'consonant clusters', 'suffix, and 'phonemes' in the running text. These terms are all explained in the text.

9.2.2   Interaction Between Text Resources

Regarding the interaction between different text resources used, this chapter involves no apparent challenges. Images are placed close to the running text they refer to, for instance the two professionals who are placed to the right of the column about which professions involving a lot of verbal communication, even though it might not be completely clear what professional role the male sitting on a stool has. The tables with subject-specific symbols are integrated in the running text, with explicit connectors such as "the following tables show…".

9.2.3   Values

The theme chosen for this chapter clearly reveals underlying values concerning "right and wrong". A main point is that there is "good" and "bad" pronunciation, and that the Singaporean variety of English is not "good pronunciation". As mentioned, the starting point is a made-up problem, with a misunderstanding caused by a /th/ pronounced as /t/ in line with vernacular Singaporean pronunciation rules. The reader is told that you need "good pronunciation" for two reasons. First to avoid misunderstandings. Second to make sure that the listener "pays attention" to what is said. The second reason is clearly value-laden, implying that vernacular pronunciation—fully legitimate within the Singaporean community—would reveal you to be less cultivated, and that you would therefore be less inclined to be taken seriously by people who "count". Thus, this statement implicitly contains values about good and bad language. The next two pages, though, are explicit about what the student should and should not do as regards pronunciation, and here, all examples given are "mispronounced words" in Singaporean English. Such a normative perspective can be

contrasted to the ways dialects and sociolects are treated as functional varieties of a language in much of modern sociolinguistics (e.g. Wardaugh 2006).

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Chapter 10
Subjects Focusing on Practical Work

In this section, we use two Swedish examples from subjects focusing on practical work, one from textile crafts in lower secondary school, and one text explaining welding techniques in vocational studies (the Industry program) in upper secondary school.

Texts connected to subjects involving craft techniques are specifically interesting from yet another multimodal perspective: instruction for action. In the Swedish school context, such subjects can be found at all levels of the school system, in subjects like crafts (textile crafts or carpentry and metal crafts), as well as vocational programs in upper secondary school oriented towards industry or automotive engineering. In many cases those subjects are not perceived as theoretical, while instead the "doing" is in focus, and the texts used in these subjects would then function as instructions (Ekström 2010). Thus, the text becomes essential for the doing, and many illustrations carry important information. However, it is not always the case that the illustrations actually function as instructions, something which will become evident in the analysis of the text from welding technique below.

10.1 Crafts, Secondary School

The text we use here is one that was used in a textile crafts classroom which was investigated for its literacy activities by Eva Lindqvist (2014). In her description of the classroom activities it was evident that the students used a variety of texts. No textbook was used, but instead different kinds of compilations or texts produced by the teacher. Regarding sewing or knitting instructions, various descriptions of the process produced for education were used. When there were no pedagogic texts available for certain processes, the students were referred to quite complex instructions available from the Internet. The text that we use here consists of two pages from a three-page

FÖRKLÄDE

- Rita av mönsterdelama: förkläde
                              ficka   (2 st)
                              knytband   (2 st)
                              nackband

- Klipp ut och nåla fast på tyg.
  Sömsmån ingår som mönstret anger.

- **VISA.** Klipp ut.

- Vik en dubbel fåll på bröstlappens svängda sidor.
  Längd-nåla.
  VISA

- Sy raksöm 2 mm från inner-kanten.
  ÖBS! Ta ut nålarna efter hand du syr.

- Vik en dubbel fåll på sidorna, först ca: 1 cm och sedan 1½ cm. Nåla
  VISA

- Sy 2 mm från innerkanten.

- Vik 1 cm på ovan-kanten mot avigsidan.
  Pressa med strykjäm.

- Vik ner kanten 3 cm. Tvärnåla.
  VISA
- Sy raksöm 2 mm från innerkanten.

- Vik och sy neder-kanten (=fållen)
  på samma sätt.

Fickor

- Vik ner ovan-kanten på fickorna 2 gånger -
  först 1 cm och sedan 2 cm. Tvärnåla.
  VISA

- Sy raksöm 2 mm från inner-kanten.

Förkläde   Sidan 1   © kerstin@juhlin.nu

Fig. 10.1 Instructions for sewing an apron, p. 1. Secondary school (re-printed with permission from Kerstin Juhlin)

booklet produced for teaching textile craft.[1] It was used in the studied classroom as an instruction for those who chose to make an apron (Figs. 10.1 and 10.2). The third page—which is omitted here—is a drawn pattern which the student is supposed to enlarge and transform on to a piece of paper to use when cutting the fabric.

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[1] An experienced teacher in textile crafts has produced the instruction and made it available on the Internet (the text is now taken away from the web page).

- Sick-sacka fickornas traskanter.
- Vik in 1 cm runt fickorna och pressa lätt.
- Placera fickorna på förklädet och tvärnåla fast dem.
  VISA
- Sy fast fickorna med raksöm ½ cm från kanten.
  Fäst i början och slutet, vid ficköppningen.

Knytband och nackband

- Vik in långsidorna 1 cm på knytband och nackband.
  Pressa lätt.
- Vik därefter banden med långsidorna mot varandra
  och tvärnåla.
  VISA
- Vik även in en av ändarna på knytbanden.
- Sy raksöm ca: 2 mm från kanten
- Nåla fast banden på förklädet och prova.
  VISA
- Sy fast med raksöm.   Se skiss

Förkläde   Sidan 2   © kerstin@juhlin.nu

Fig. 10.2 Instructions for sewing an apron, p. 2. Secondary school (re-printed with permission from Kerstin Juhlin)

10.1.1   General Structure and Setting

The writing is structured in bullets, and placed to the left on both pages, with headings in italics. To the right are drawn illustrations with no headings. Both the writing and illustrations are visually prominent. The stylization of the illustrations, with clearly marked contours in black, contribute to their prominence on the page.

The expected reading order might be to follow the bullets one by one and shift between writing and illustrations.

Apart from the first heading, "Apron" (Sw. *Förkläde*), which is centered and set in a bigger font, the headings correspond to different parts of the apron. The first part

of the process—sewing the main part of the apron—has no heading. This instruction appears directly under the main heading.

10.1.2   Interaction Between Text Resources

The illustrations are central in the description of the process. The stylization contributes to the "doing" that is expected from the text: seams, hems, etc. become fairly distinct. The written text refers to the illustrations, though not explicitly, as might have been expected in an instructive text like this.

Furthermore, a number of concrete, subject-specific concepts are used only in writing and not in the illustrations. Thus, it is implied that the student either is familiar with the concept, or that a teacher is expected to support the process. Quite often you can guess what the term refers to, for example to pin lengthwise (Sw. *längdnåla*) or crosswise (Sw. *tvärnåla*) on the first page. However, there are also instances where there is nothing in the illustration that corresponds to the written instructions. One such example can be found on the second page, where in writing it is said that you should "zigzag the raw edges of the pockets" (Sw. *sick-sacka fickornas traskanter*). Neither "raw edges" nor zigzag stitches are shown in the illustrations. Instead, the illustration connected to this part of the instruction depicts the next stage, namely the folded edges along the sides of the pocket. Therefore, what corresponds to "raw edges" or the result of a zigzag seam is expected already to be clear for the student using these instructions.

The various illustrations lack headings or captions. Thus, the reader is expected to know when to use the illustrations and when only writing is expected to carry information about the process.

The illustrations function mainly to *depict* various parts of the process, or to *visualize* or *concretize* what is said in writing. One example is where it is said in writing that the edges of the curved part of the apron should be pinned lengthwise, and where the illustration depicts pins along a hem.

At times, the illustrations supplement the writing, for example when the illustrations only depict the "reverse" (Sw. *avigsidan*) or at the bottom of the second page, where the text says "Sew together using straight stitching. See illustration." This is the only place where the text explicitly refers to an illustration, although which one of them is implicit. What is probably referred to is the detailed illustration of the bib, where a cross marks the place where the tying strips are supposed to be stitched to the apron.

10.1.3   Values

There are no explicitly expressed values in this text. However, we may note an implicit discourse based on meticulousness and control. The expected accuracy is

shown through the detailed descriptions of the process (exact distances between edge and seam, and instructions as to how to fold the hem). The same thing is shown in the illustrations depicting details in the process. The importance of control is shown in the recurring request "SHOW" (Sw. *visa*) in the writing. Thus, the teacher is supposed to check that central steps during the process have been performed correctly—and probably in a meticulous way—before the student is allowed to go on to the next step.

With a greater focus on creativity, the text might have included some encouragement to use your imagination regarding the choice of fabric, or perhaps urged students to make decisions regarding ways of designing different parts of the apron. Of course, nothing prevents the teacher from encouraging the students to be creative in the classroom practice, but if we only look at what the text encourages, meticulousness and control appear to be important. The same thing was noted in the welding text, which we will look at more closely in the following.

## 10.2 Welding, Industry Program

In vocational studies in Swedish upper secondary school a number of subjects involving practical processes are included. The Industry program includes a number of practical courses with direct relevance for future work in industry. However, to be able to pass such courses, a knowledge of subjects like physics is also required. In this particular case we will look closely at a course in welding techniques. According to the curriculum, students are supposed to develop knowledge about the risk of deviations in form and inaccuracies, and how to avoid and remedy the faults.

In a textbook on welding (Henriksson and Hällman 1999) one chapter deals weldability (Sw. "*Svetsbarhet*"). This covers aspects such as how shrinking and expansion in the metals are associated with temperatures, and how this has consequences for the welding process (Henriksson and Hällman 1999, pp. 95ff).

In a doctoral thesis, Pia Visén investigated text talk in upper secondary school. In her investigation, this section in the textbook was used (Visén 2015, also see Hallesson and Visén 2018 in which text talk during the same lesson is analysed). In her study she showed how the teacher in his exposition about welding stuck very closely to the textbook, though never referring to any sections in it explicitly. Her analysis also revealed that the teacher made no connections to the illustrations in the textbook.

10.2.1 General Structure and Setting

The book spread contains both writing and illustrations such as diagrams. The writing is sequenced in sections under a number of headings. The illustrations are placed either to the right of the written text or below it. Both writing and illustrations are
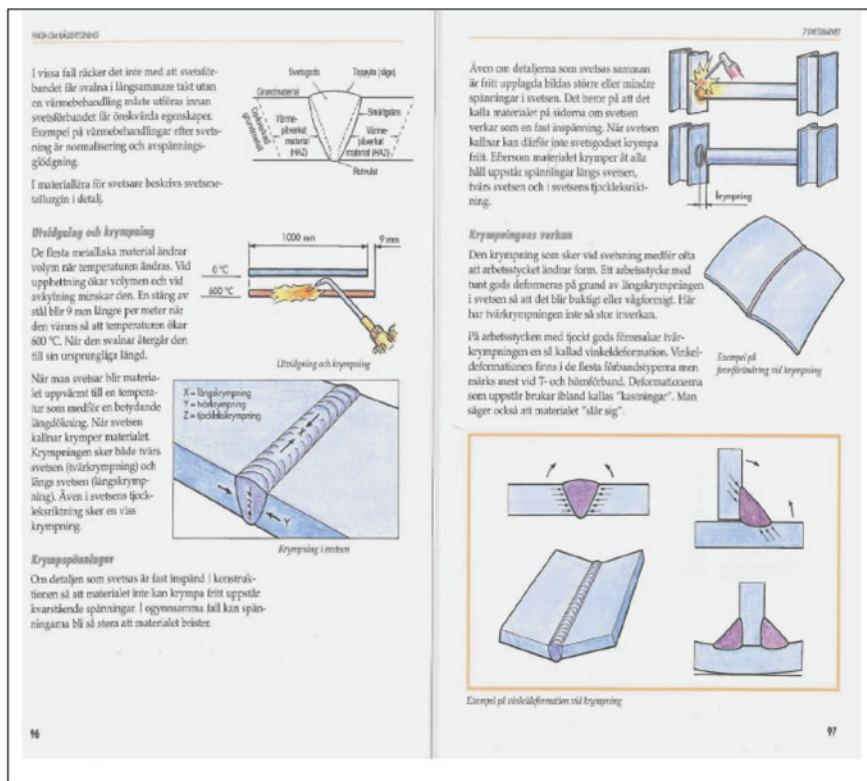
Fig. 10.3 Welds. Facts about welds. *Bågsvetsning. Fakta om bågsvetsning* (Henriksson and Hällman 1999, pp. 96–97, with permission from Liber)

prominent, and the placement of the illustrations invites the reader to read from the top of the text and then down, shifting between writing and illustrations (Fig. 10.3).

The content is thematically arranged, starting with overarching content about how materials are affected by heat and cold. The headings in the book spread, "Expansion and shrinkage" (Sw. *Utvidgning och krympning*), "Tensions due to shrinkage" (Sw. *Krympspänningar*), and "The effect of shrinkage" (Sw. *Krympningens verkan*) support the reader in following the thematic structure.

10.2.2 Interaction Between Text Resources

The book spread contains different types of illustrations. One example is the schematic image, or sketch, of a weld on top of the left page. This illustration is more abstract than the other illustrations, and it is of a type that can be expected to be found in handbooks for welders, that is, for people working in the profession. The

rest of the illustrations concretize the content given through writing, with a design that appears to be more in line with concretizing images in instructional pedagogical texts. Writing and illustrations are closely connected and the illustrations cannot be fully understood without the written information, while the illustrations *concretize* or *complement* the information given through writing.

Throughout the text, the images consist of concretizing images focusing on the weld and the material connected by the weld, which is fully congruent with the writing. Metal pieces are depicted in blue color while the weld is purple. It is particularly instructive that the more abstract depiction at the top of the page and the more concrete illustration at the bottom of the same page exhibit clear resemblances.

Thus, there is a clear *congruence* between illustrations and writing in this text. Further, the illustrations are closely connected to the writing on the whole. Also, regarding the layout of the book spread, illustrations are placed in direct relation to the written text. Moreover, the same concepts are used in both writing and illustrations, with one exception. This concerns the sketch at the top of the page, depicting a cross-section of a weld, presenting a number of terms. These terms are both subject-specific (e.g. "Weld metal" [*Svetsgods*], "Weld face" [*toppyta*], "Weld Junction" [*smältgräns*]) and more general concepts ("Heat-affected material" [*värmepåverkat material*], "Base material" [*grundmaterial*]). None of these terms are mentioned in the corresponding written text. The same is true of the abbreviation HAZ, which stands for *Heat Affected Zone*,[2] an abbreviation which is not explained in the book. The meaning of the abbreviation is implicit in the abstract sketch, since the abbreviation is placed between brackets after "Heat-affected material". Later in the book (p. 139), the abbreviation is used in writing, although here too without an explanation: "In order to test the malleability of the weld and the area around the weld (HAZ) a bending test is made." In the textbook, the abbreviation is used in relation to both "heat-affected material" and "the area around the weld". In the latter case it is implicit that HAZ is connected to an area affected by heat (i.e. the area directly connected to the weld).

In relation to the image at the center of the left page, we note the conventionalized color coding for cold (blue) and heat (red). A welding nozzle directed towards the red bar also functions as a way of elucidating the heat.

The illustration in the middle of the left page is interesting in a number of ways. It is supposed to elucidate that metal expands when heated. According to the illustration, this means 9 mm per meter, if steal is heated to 600 degrees Celsius. For obvious reasons, the distances in the illustrations are fallacious. At the same time, the convention of marking exact distances between the ends of two arrows is used, as in the case of the meter length. In technical drawings, however, the relations between different dimensions or distances are usually scale models with conventions such as a broken or dashed line to mark broken lines, which could have been utilized in this text too, to elucidate that the figure is not drawn to scale.

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[2]In the text talk that Pia Visén (2015) analyses, the teacher explains this concept using both the English term and a translation into Swedish (*värmepåverkat material*).

Moreover, the illustration contains a mixture of concretion and abstraction when depicting a welding nozzle heating the steel at the same time as conventionalized choices of red and blue for heat and cold are used. However, it is unlikely that the welding nozzle could heat a whole meter of steel up to 600 degrees Celsius.

The illustrations contain arrows denoting different things. In the uppermost illustration, arrows are used both to mark the labeling of different parts of a weld seam ("Weld metal" [*svetsgods*], "Weld face (reinforcement)" [*toppyta* (*råge*)], "Penetration bead" [*Rotvulst*], "Weld junction" [*smältgräns*]), and to mark a limit between the material directly connected to the weld "Heat-affected material [HAZ]" and the unaffected material. Here two arrows pointing two ways from the label are used. There appears to be no reason why no arrows have been used to mark "Base material" and "Unaffected base metal" (Sw. *Opåverkad grundmetall*). From the labeling no information is given as to whether the material on the other side of the weld is "base material" or something else. One may also wonder whether there is a difference between "metal" and "material" in the illustration.

Another way of using arrows can be noted in the middle of the page. Here the upper arrow, pointing two ways, is used in accordance with the convention of marking the beginning and end of a length, in this case 1000 mm (representing the metal before being heated). For some reason the same kind of arrow is not used to mark beginning and end of the 9 mm expansion that occurs during heating. Instead, that arrow points to the right line demarcating the end point for the metal balk during heating. Another way of showing the expansion, which would be more in line with the genre convention, would be to write 1009 mm at the red (hot) girder, by analogy with the length mark for the blue (cold) girder.

In the illustration at the bottom of the page, the arrows mark shrinkage. Here a number of arrows are used in different parts of the illustration. Some of them are placed in the depiction of the weld while some of them are placed in the different parts that are supposed to be connected by the weld.

Throughout this textbook, illustrations contain important information at the same time as they are quite demanding for the reader. The written text is demanding too, due to a style associated with the language of science. Examples of challenges in the language of science are a large number of subject-specific terms (*weld junction, HAZ*) and the use of so-called grammatical metaphors, such as converting verbal phrases into noun phrases (e.g. Schleppegrell 2004). One such example in this text is "a considerable *length increase*" (Sw. en betydande *längdökning*) (cf. "the steel girder becomes much longer"). One effect of such conversions of verbal phrases into noun phrases is that the text becomes denser. At the same time processes (something becomes longer) are transformed into phenomena (increase [noun]). Such linguistic choices have been observed to be challenging for students, and it is claimed that students might need help to "unpack" these grammatical metaphors (e.g. Fang and Schleppegrell 2008; Halliday 1998/2004). It is common for teachers to be aware that subject-specific concepts can be challenging, though the awareness of grammatical metaphors is less widespread among teachers.

10.2.3   Figurative Language

This text contains metaphors that are part of the language of technology or science, such as *tensions* (Sw. *spänningar*) and *stress relieving* (Sw. *avspänningsglödning*). We also note that the authors of the book make this explicit in a case where the metaphor about the way that a material can change its shape may be mistakenly understood as an everyday expression. In this case, the expression results in a homophone which means "warp" but can be understood as the colloquial phrase meaning "hurt oneself" (Sw. *slå sig*). The quotation marks and the words "we say" indicate that there is a the potential ambiguity in this expression, however.

10.2.4   Values

There are no explicit values in this text. However, as in the crafts text above, there is a clear message that within this discipline you need to be both knowledgeable and meticulous to avoid inferior results when welding.

10.2.5   Classroom Focus

This text functions as a basis for doing something (joining pieces of metal by welding) at the same time as it is highly theoretical. Also, the content is a prerequisite for the high quality of the final product (the weld). Taken together, in particular the scrutiny concerning the interaction between text resources reveals that this is a complex text, as regards both writing and illustrations. For such texts, text talk and mutual reading can be efficient for supporting the students in their text use. Hence, concerning texts like this, we would strongly encourage teachers to first make a close reading of the text to uncover possible challenges concerning the text resources used and the interplay between them. As a next step, the teacher and the students discuss the text, focusing on the different text resources and to clearly connect the discussion to the content and how to grapple with texts like this.

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Textbooks

Henriksson, I. & Hällman, T. (1999). *Bågsvetsning. Fakta om bågsvetsning* [*Arc welding. Facts about arc welding*] Stockholm: Liber.

Chapter 11
Mathematics

Here we have chosen to analyse a section from *The Cambridge Primary Mathematics, Learner's Book 2* (Moseley and Reese 2014). It is an ambitious textbook launched as "a supplementary resource that consolidates and reinforces mathematical learning alongside the *Cambridge Primary Mathematics Teacher's Resource 2*". At the bottom of each page there is information that relates to a "core activity". The resource is "dedicated to helping schools develop learners who are confident, responsible, reflective, innovative and engaged" (*Introduction* page). In the following we shall here look closely at two pages, the one about *Patchwork*, the other about *Balls*, and in this, we focus on the interaction between text resources used.

11.1   Interaction Between Text Resources

At the top of the page about *Patchwork* there is text that directly leads the reader into the visual illustrations ("Look at the pictures"), followed by the questions: "What can you see?" and "Talk about what you can see." Here we can immediately see the intentions behind the book: look, reflect, think, and talk about it. Fig. 11.1.

The following text concentrates on squares and triangles, of the same or different size. However, by just looking at the page, it is not evident what the purpose is, and this shows clearly enough that the book is to be seen as a complementary resource to the teacher's introduction and instructions.

With this in mind, let us have a closer look at the text. In the upper left illustration we notice squares with lines, waves, and dots. The illustration in the middle is focused on squares and triangles, while the one to the right also contains some kind of extra information in the form of wave-like patterns (fishes or eels with eyes?). This extra information (lines, waves, dots, and patterns) might distract the focus on squares and triangles. From the book alone, then, it is not clear that you as a pupil should train to make comparisons between different geometrical forms. It also seems unclear what
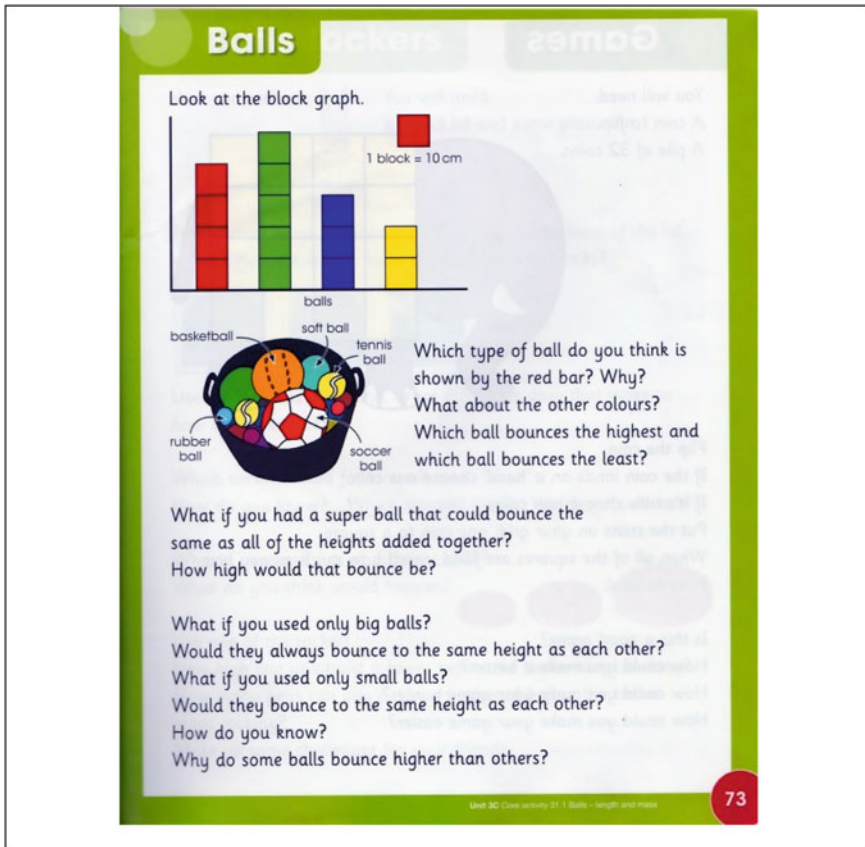
Fig. 11.1 Patchwork. *Cambridge Primary Mathematics Learner's Book 2* (Moseley and Reese 2014, p. 72, with permission from Cambridge University Press)

to *do* with this information, since there is no explicit instruction that asks you to do what the two pupils (at the middle/right illustration) are doing.

The following page about *Balls* seems to be even more complicated (Fig. 11.2).

This page starts with a "block graph", under which we find a basket with balls of different sizes and colors. These illustrations are then accompanied by a number of questions. But let us start with the illustrations. What might be a bit confusing is that there are no clear links between the colors of the bars in the graph and the colors of the balls you *can see*. So, after a while you perhaps think that the graphs are not about how many balls there are of each sort, even though the word "balls" under the graph may indicate this. Color is also a textual resource, and thus carries

Fig. 11.2 Balls. *Cambridge Primary Mathematics Learner's Book 2* (Moseley and Reese 2014, p. 72, with permission from Cambridge University Press)

information. In this specific case, however, it might be confusing since you cannot see all the balls in the basket to which the graph refers: one light red ball (not four), one green ball (not five) two purple balls (not three), but two yellow ones (as in the graph).

One of the following questions is: "Which type of ball do you think is shown by the red bar?" You may even wonder if this question is linked to the following one: "Which ball bounces the highest and which ball bounces the least?" With these questions we have left the mathematical definitions, and the textbook here refers to the reader's own (culturally based) empirical experience or knowledge. If you do not have this knowledge, you are left to guesses only.

In sum, we could say that a rather reduced and focused text like this one contains a number of possible challenges. It therefore seems important that the teacher discusses some of the missing linkages between the written text and the visual illustrations, makes clear what the task is about and perhaps also introduces some experimental

work, so that the pupils instead of guessing could explore different qualities of different balls, and make up new graphs themselves.

Textbooks

Moseley, C. & Rees, J. (2014). *Cambridge Primary Mathematics. Learner's book, 2.* Cambridge: Cambridge University Press.

Chapter 12
Websites as Learning Resources for Young Learners

Today there is a plethora of Internet sites aimed at young learners. In the following we comment on a website, National Graphic Kids, published by *National Geographic* as an example. However, due to copyright reasons, the figures used in the following derive from a similar Swedish website, Youngfacts. The interested reader is referred to the following link to get access to National Geographic Kids: https://www.natgeo kids.com/uk/category/discover/. We will not go through all aspects of the model, but instead give some general comments on that type of learning resource.

Figure 12.1 gives an image of a common overall layout of such websites. At the general level, they typically invite the user to explore the content independently, by using links given through images combined with written words.

In both National Geographic Kids (NGK) and the Swedish example, the starting page contains links through images inviting the reader to explore a number of "facts" related to, for instance, themes as science and history. Examples from NGK are a cartoon-like image of a woman combined with "The life of Rosa Park" in words, and an image of viruses combined with "What is coronavirus?". Through menus at the top of the page of NGK, the user can choose to focus on one theme at a time, in this case Animals, Science, History, and Geography. Here we note that Animals is a category separate from science, probably since visitors to the site may be expected to be especially interested in animals. Also, that page calls for some interactivity, with a quiz based on multiple-choice questions, though for the most part, links lead to informative sub-pages with texts to read, just like the Swedish website (e.g. Fig. 12.2).

As regards interpersonal aspects, it is obvious that the site has two expected audiences: the curious child and an adult (teacher or parent). The voice is direct, addressing the child as "you", and there is an extensive use of exclamations marks. Furthermore, facts are presented as "fun", "cool", or "amazing", in ways that are not expected in traditional textbooks. Also, colloquial expressions such as "ready to blast off?", or "this fab fruit?" (the tomato) are used, further enhancing the idea that learning is really fun. The images providing links are often based on indisputable facts rather than more complex problems, for instance "10 facts about…". The general tone

Fig. 12.1 Screenshot 1 from website for young learners (UngaFakta 2020, printed with permission from UngaFakta)

is that it is fun to learn: from their website young learners "discover some incredible secrets, awesome theories and explore some bonkers experiments".

When clicking the links, the visual presentation of the texts is similar to that of textbook texts with images combined with writing (see Fig. 12.2). In NGK, the language style is a combination of colloquial expressions and specialized terminology, for instance in a text about the digestive system where expressions like "the chewed *grub*" are combined with "salivary glands" or "oesophagus" (https://www. natgeokids.com/uk/discover/science/general-science/your-digestive-system/).

To sum up, such websites display a balancing act with a prospect to draw the child into traditional "school content" as something fun. This is done by the use of clickable images leading to "Facts about …", often with photos and expressions displaying an overuse of exclamation marks and adjectives such as "awesome" and "exciting", often in combination: "10 fabulous facts about Diwali!". When clicking the links, a textbook like page appears presenting indisputable facts through the combination of colloquial style and a specialized language.

Fig. 12.2 Example of text provided behind links: Egypt of the Pharaos (UngaFakta 2020, printed with permission from UngaFakta)

Textbooks

Ungafakta (2020) www.ungafakta.se [2020–11–18]

Chapter 13
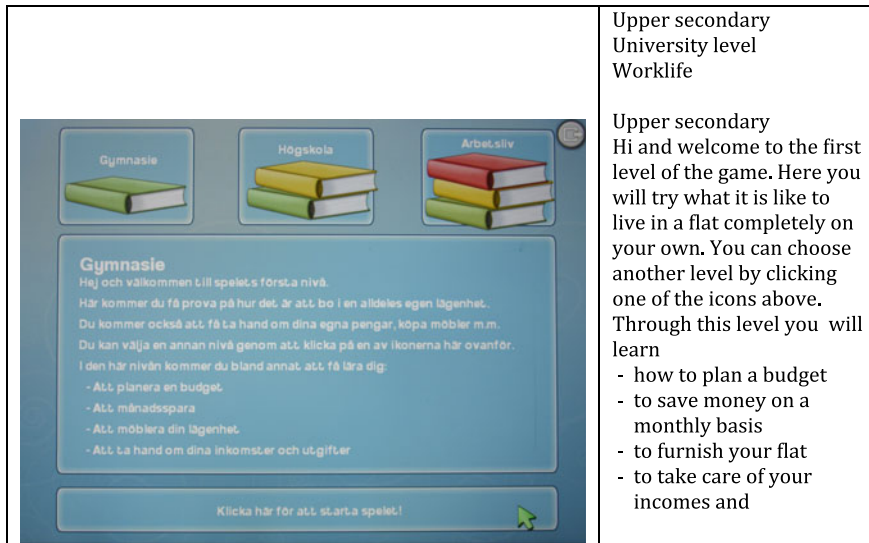# Educational Games and Online Resources

The importance of games and simulations within education are increasing (Arnseth et al. 2019; Gallagher 2015; Mørch and Thomassen 2016; Squire 2011). In the following we have analysed one example of a game developed for educational purposes, namely *The Economy Game*. It is not a new one, and it appears as quite traditional. Then we will comment on the Swedish game *Minecraft*.

In applying our analytical model to games and other online resources, including such resources as the website commented on in Chap. 12, we are well aware of the difficulties related to multi-layered and dynamic representations, where the user's actions in many ways will steer which information will be brought to the fore and seen on the screen. At the same time, the architecture behind a game does not allow for any kind of actions, and, as we shall see, there might also be certain values embedded in a game.

We here want to emphasize three things: (1) games must be understood as a text that relates to the actions of the player, not as a fixed text; (2) therefore, the best way to study this type of text is to study gaming; (3) it is possible, however, to capture some salient aspect of a multimodal text of this kind, as well as some of the underlying values.

13.1 The Economy Game

This learning game is freely available from a website called "Young Facts" (Sw. *Unga Fakta*), where one section is labeled "Young Economy". In this section, the starting page tells the user that it is important to have some knowledge about one's own economy. The starting page of the game is shown in Fig. 13.1 and it reveals that there are three levels to the game. You are recommended to start at the first level, where you are supposed to pretend that you are going to live on your own for one year at upper secondary school.

| | Upper secondary
University level
Worklife

Upper secondary
Hi and welcome to the first level of the game. Here you will try what it is like to live in a flat completely on your own. You can choose another level by clicking one of the icons above. Through this level you will learn
- how to plan a budget
- to save money on a monthly basis
- to furnish your flat
- to take care of your incomes and |

Fig. 13.1 Starting page Economy Game (UngaFakta 2020, printed with permission from UngaFakta)

13.1.1 General Structure and Setting

The structure of this game is fixed and the layout is relatively sparse. When starting the game you first have to go through a number of informative pages about how to play the game, for instance that you first of all need to make a budget. Here you also get an explanation of what a budget is.

A number of parameters of the game are fixed, for instance the fact that you need to make a budget, and that you have to deal with a number of economic events each month (invoices, neighbors who pay visits to borrow money, etc.). Depending on your choices, such as accepting a subscription offer from a magazine, or lending money to a friend, new things will occur the following month.

The game contains links, marked with an *i*, to various sorts of information, and the player is explicitly told to click on these links for information. By using a "noteboard" in the flat, the player can go back to the general information given before starting the game.

The player thus has to start up making a budget (Fig. 13.2), where the steady sources of income are already there, while the player can choose how much to spend on consumable goods (Sw. *förbrukningsvaror*), such as food, clothes, and hygiene, and how much to save. On this page, an explanation of "surplus money" (Sw. *överskott*) is given if you click *i*.

Fig. 13.2 A budget in the Economy Game (UngaFakta 2020, printed with permission from UngaFakta)

Apart from the fixed gaming parameters mentioned above, a number of economic parameters are also fixed in this game. Examples are the sources of monthly income, such as student grants and maintenance, which appear to be in line with the Swedish terms. The cost of rent is also fixed. Therefore, the player cannot choose a cheaper way of living, such as renting a room or sharing a flat with others.

Given the fact that this game is supposed to be used to learn about private economy, it is somewhat surprising that no information is given about reasonable costs for food, consumable goods, or the like. In a game like this, links to other websites with that kind of information could have been included. Also, one could argue that choices such as "no fast food or restaurants" or "no unnecessary costs for clothes this month" would be available (or the opposite, to see the consequences of excessive consumption). If students are using a game like this, it would be wise to supplement the game with classroom discussions and collaborative learning activities, for instance to search for useful web resources about private economy, or what standard of living is suggested as reasonable.

Also, it is astounding that this game gives you a warning if you have spent too *little* on clothes, and that you therefore are running a risk that people around you "might start complaining" (see Sect. 13.1.2). Furthermore, in the game you can only plan for such costs in the budget, while you cannot decide *when* to go out to buy your soap or your clothes, or *what* to buy. With regard to furniture, and technical products such as computers and television, you decide for yourself when to buy things, and

Fig. 13.3 Furniture shop in the Economy Game (UngaFakta 2020, printed with permission from UngaFakta)

how much to spend (there are different price categories) (Fig. 13.3). Though you cannot choose to buy things second hand to keep your costs low. However, if you get into financial trouble, you can decide to sell a piece of furniture and get a refund of about half of the price.

13.1.2   Interaction Between Text Resources

Figure 13.4 shows the flat the player lives in, and in the lower part of the screen a number of symbols for game episodes automatically generated by the game. The symbols are more or less conventionalized, combined with different coloring. A green dollar sign means incomes, a red one for invoices that need to be taken care of. The color coding is equivalent to that of calculation software, in which negative numbers are displayed in red. A letter symbol is used for episodes that you need to take care of at a more or less daily basis, like offers from magazines, or for phone subscriptions.

When clicking on triangles with exclamation marks, you can read that you have spent too little on food, clothes or hygiene (Fig. 13.5)—though as mentioned above, what is a reasonable budget for that is not indicated. Beside the dollar sign in the

Fig. 13.4 Layout in the Economy Game (UngaFakta 2020, printed with permission from UngaFakta)

	Low level of hygiene
	You have spent very little on hygiene articles the past month. If you do not do something about it, there is a risk that people around you will start complaining.

Fig. 13.5 Hygiene warning in the Economy Game (UngaFakta 2020, printed with permission from UngaFakta)

upper right corner, you can see how much money you have got. The dollar sign is thus used as a general symbol for economy, though you cannot choose currency in your budget (instead Swedish crowns, SEK, appear to be default).

13.1.3 Values

The values given through the game is only commented on briefly. An obvious one is of course the whole idea behind the game: that it is important to be able to make a budget, and to have your private economy under control.

However, there are other values in the game as well, some of which have been commented on above. One such example is that the game warns you when you have spent too *little* on, for instance, clothes. Another value given in the game is that you should help your friends. If you agree to lend some money to a friend (a boy) who is lagging behind with his rent, the next month you will get back the same amount of money plus an extra sum, as a thank you from your friend, who happens to have won some money on lottery, and wants to share it with you as thanks for the help.

Since a number of implicit values are built into this game, it can be fruitful to let the students reflect upon them and discuss them in class, not least since some of these values are more or less in conflict with the general discourse about spending today.

13.2 MinecraftEdu

Minecraft was originally launched in 2011. This game seems to be very engaging, and it gives the player an opportunity to build things by using different kinds of (virtual) blocks. It supports creativity as well as the testing of different solutions, and it gives a feeling of mastery through immediate and relevant feedback. The learning process can be both individual and collaborative. The game appears in different "modes": in the "survival mode" or "hardcore mode" of the game, you can build tools to kill animals or monsters, but in the "creative mode", you can concentrate on building things—such as a piano or parts of the body, or houses and communities. This mode is the one that is mostly used in school contexts.

MinecraftEdu (also called "vanilla" Minecraft) is an adapted version of Minecraft for educational use. However, in both versions you can set up a "joint world" (using the local area network—LAN) for teachers and students. In fact, many teachers seem to still use the Minecraft version and not MinecraftEdu. You can play Minecraft and MinecraftEdu as a single player, but it also supports collaborative learning and communication, for example in a class.

MinecraftEdu can be used in different school subjects, for example to explore content and locations in history lessons or to construct maps to navigate in a (virtual)

environment. In addition, you can explore biological mechanisms or train mathematical skills, etc. It is also possible to support transdisciplinary learning, which is enhanced under the label of "21st Century Skills" (or "Competences"), as well as to support pupils with special educational needs.

In such games, the students have to gather information or build something up. As a teacher, you can also add tasks, example the possibility for the students to write, so that the students can practice writing along with their gaming, and thereby benefit from the joint engagement in the classroom. However, it is important to make the learning goals and objects of learning explicit to the students.

Minecraft is but one example of on-line resources that could be used in education. The reason for mentioning it here is that it is an example of a game that includes the possibility to add chats and other sites for communication and reflection.

13.3 Using the Model for On-Line Gaming

As is evident from our analyses of digital websites and educational games, our model for working with multimodal texts can be utilized for various online resources as well. However, since not all digitized material is produced for educational purposes, the use of such material primarily require answers to the question of educational relevance. Also, such use requires a reorientation of traditions and routines in educational planning, as well as in existing cultures of recognition and testing practices (Kress and Selander 2012; Selander 2008, 2015). In gaming, the player will show his or her understanding through acting within the frames of the game or simulation. Therefore, there is a need for new ways of tracking discussions between students, as well as decisions made in the game over time. To conclude, by using digitized tools and environments, the range of ways to show learning and knowledge ('signs of learning') changes. In the case of collaborative problem solving, our model could help both to guide the construction of the "testing" situations, and the interpretation of the results. With this said, with minor adjustments our model for working with multimodal texts can be a useful tool for teachers who want to use online resources in education in meaningful ways.

A starting point for working with the model is to analyze the general structure of the text, including such aspects as thematic orientation and sequencing, followed by the interaction between textual parts. However, when using gaming and other online resources in education, it seems relevant to also look at the *student's* interaction *with* different parts of the text (e.g. the game), both in terms of what possibilities there are in the game and in terms of choices made by the student.

As regards figurative language, the games can be scrutinized for example by looking at what domains the game or simulation uses for the exercises in mathematical, historical or other subject domains. Here it is relevant to discuss with the students for instance to what extent the game builds on analogies between the real world and the imaginative world of the game, and to discuss possible limits with the choices made by the constructors of the game.

Concerning explicit and implicit values, it is important to look into what kind of actions that are requested or possible in the game, and to discuss these in relation to values with the students. Another aspect of value in relation to gaming—in fact in relation to any learning activity—concerns what kind of learning the game, or activity, contributes with. Even though the use of games in education can be engaging for students, that is not an end in itself. Instead, all learning resources must be used for a specific purpose within the frames of the educational setting.

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Chapter 14
Summary of PART II

Based on the model presented here for multimodal text analysis, we have analyzed a number of texts from a variety of subjects. The examples have mainly been taken from printed and digital textbooks, but we have also commented on websites and educational games for young learners. As regards the *educational perspective*, we have also commented on aspects of the texts that teachers and students can discuss in relation to different aspects of the model. Such discussions can be organized either through classroom discussions, or by way of digital media. Blogs can be utilized, as well as web-based resources enabling anonymity among the users, which can encourage more voices to come through in the collective learning process. What choices to make always depends on the student's age and his or her prior experience of using digital media for similar purposes.

The outset of the above analyses is the *general structure and setting* of the texts. Here we have commented on aspects such as *sequencing* and *thematic orientation*. The aim of starting with that is for students and teachers to get an overall impression of the role of different visual resources and what they offer the reader. With regard to the educational perspective in this part, we have tried to point out aspects of the texts that teachers and students can pay special attention to in the classroom, especially regarding potential challenges in the specific texts.

As a second step, we have elucidated the *interaction* between parts of the text. Such interaction can concern *visual proximity* and *congruence* between the verbal text and other semiotic resources, but also the *congruence* between, for instance, the use of concepts in descriptions and explanations. As regards the *educational perspective*, teachers and students can reflect upon the interaction between resources, and what view of the knowledge area appears to be central in the text, and furthermore to clarify aspects that might be unclear or even lacking in the text for the content to become clear.

As a third step of the analysis, we have focused on *figurative language*, given both through verbal language and through other resources. From the *educational perspective*, teachers and students can "break up" the content of the figurative language and,

for instance, discuss the reach of analogies and how well they function in relation to the content in question.

The final step of the analysis deals with *explicit* and *implicit values*. Implicit values can for instance be given through metaphors or in illustrations, or through the choice of content. In relation to the *educational perspective*, teachers and students can discuss dichotomies such as right or wrong, us or them, male or female, explicit or implicit, since such dichotomies, whether in combinations or singly, can reveal underlying values.

We would like to stress two things in particular. First, multimodal analyses can be an aid for teachers to reveal a number of specific features of the text, and this can be a basis for classroom discussions with the students. That, however, does not mean that the teacher needs to point out all the different aspects in every single multimodal analysis. Second, the teacher can always decide to attach more or less weight to the different aspects when analyzing the texts. For example, when working with a topic such as attractive force in the physics classroom, discussing values might not be as important or interesting as it would be in history or religion.

Also, we want to point out that close readings of text quite often lead to expositions of potential challenges or even discoveries of "flaws" in the text. We would claim, however, that it is almost impossible to write a textbook that works perfectly for students without giving them some kind of scaffolding. Therefore, our main aim in developing our model, and in scrutinizing texts with the help of it, is to provide teachers and students with tools that can be helpful in various text encounters. Also, when students have developed their knowledge about texts and multimodality at a general level, this knowledge can be used to cope with a variety of textual challenges.

14.1   Texts and Multimodal Text Focus in Different Content Areas

In some content areas, highly abstract or complex content needs to be concretized, such as the digestive system, chemical bonds in science, or political systems and aspects of social security in social sciences or economics. Quite often, seemingly simple texts contain a number of potential challenges. This in combination with unclear connections between verbal text and illustrations can lead to unnecessary challenges for the novice in the field. In each text encounter, students need to be aware of the ways in which all semiotic resources, in themselves or in combinations, may carry important meaning.

In our model, special attention has been paid to figurative language. Within the science area, metaphors are part of the disciplinary discourse. At the same time, different forms of figurative language are used for pedagogical reasons to connect to students' everyday life, or to visualize abstract content. Since figurative usages are so affluent, there are good reasons to discuss them and to "unpack" them to discuss their "reach". Such discussions can also be enlightening for the teacher, who can

then see what ideas they lead to among the students. This is important, not least from the perspective of second language learning.

Social sciences, too, use an abundance of metaphors. Here the question of values becomes especially important. Some values are clearly and openly expressed, while others are more hidden in writing and illustrations. One way of making values visible is to make comparisons. Especially dichotomies like us/them, female/male, center/periphery can make visible what is implied in the text. Another aspect of values in texts is the fact that the choice of illustrations can encompass stereotypes in ways that might not be as obvious as they would be if given through words.

When analyzing digital texts it is perhaps even more evident what a multimodal analysis can do. Such texts often contain numerous animated or still visual illustrations of various kinds, sometimes in connection with audio clips. Since digital texts often include links, there is no clear reading order, and in the case of external links there might be uncertainty about what is actually "the text". The use of digital games has also become more common in teaching and learning. In these cases, it is important to scrutinize the content and what you can actually learn from the game, with or without other resources. As we have shown in analyses above, our model can also be a tool for assessing the learning potentials of games.

A number of subject areas have components of "doing" apart from the more theoretical aspects of the content. This accounts for parts of mathematics, experimental work in the science area, the critical discussions of source material in history or exercises in producing different genres in mother tongue subjects. Some school subjects also have a clear emphasis on training practical skills, such as music and design, crafts, or vocational programs.

14.2   Multimodal Texts and the Future of Learning

Even though we use a couple of examples from pedagogical games and an Internet page used for the early school years, we have mainly focused on printed textbooks or textbooks that have been published in two versions: one paper-based, one digital.

However, there are good reasons to be open to the challenges associated with digital techniques such as mobile learning, the flipped classroom, video communication, simulations, and game-based learning. With texts used in such settings, multimodal aspects are vital for information and knowledge processing as well as for knowledge representation.

We hope that a greater and more systematic focus on multimodal aspects of texts, where our model can be one important tool, can be one way of dealing with the new text landscape associated with the digitization of education. We also hope that our way of tackling texts can make teachers feel confident when working with multimodal texts in these new domains, with regard to (i) the evaluation of content and structure in text that students encounter in their learning process, (ii) cultivating students' multimodal text production, and (iii) the assessment of students' multimodal texts.

14.3   Afterword

Our model was developed for analyzing and working with texts such as the ones analysed in Part II of the book. Since it was developed in relation to multimodal texts, from an extended text concept, it has later been adapted and used in wider contexts. One example is an analysis of a physics lesson, where the lesson itself including activities and resources used was regarded "text" (Danielsson 2017). In another study the model was used to analyse museum exhibitions (Insulander 2019).

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